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TITLE OF THESIS... *AN ANALYSIS OF THE DEMAND*
FOR PHYSICIANS' SERVICES
IN SASKATCHEWAN.....
UNIVERSITY... *ALBERTA*.....
DEGREE FOR WHICH THESIS WAS PRESENTED... *PH.D.*.....
YEAR THIS DEGREE GRANTED... *1971*.....

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THE UNIVERSITY OF ALBERTA

AN ANALYSIS OF THE DEMAND FOR PHYSICIANS'
SERVICES IN SASKATCHEWAN

by



R. G. BECK

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF ECONOMICS

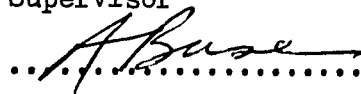
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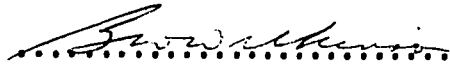
SPRING, 1971

UNIVERSITY OF ALBERTA
FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend
to the Faculty of Graduate Studies for acceptance, a thesis entitled
AN ANALYSIS OF THE DEMAND FOR PHYSICIANS'
SERVICES IN SASKATCHEWAN
submitted by R. G. Beck in partial fulfilment of the requirements for
the degree of Doctor of Philosophy.


.....
Supervisor


.....


.....


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.....
External Examiner

Date April 15, 1971

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ABSTRACT

The introduction of federal medical care insurance in Canada, at a time of rising costs of health care, has spurred public interest in methods of controlling health costs. The province of Saskatchewan, after five years of universal medical care insurance, introduced utilization fees or coinsurance as one means of stemming increased costs. This thesis examines the Saskatchewan experience to determine the effects of utilization fees. Income and other explanatory variables are included in what is essentially an empirical study.

This study has a twofold purpose. First, since no published data exists on families' use of physicians' services, data had to be collected. Chapters Two and Three of the thesis explain the sources and nature of the data. The agencies providing data are the Saskatchewan Hospital Services Plan, the Saskatchewan Medical Care Insurance Commission, and the Saskatchewan Treasury Branch. The records from these sources are linked for a cross section random sample of about 40,000 families, repeated for each of the years 1963 to 1968.

The second purpose of the thesis is to examine, using multivariate single equation regression analysis, the effects of a number of explanatory variables on family utilization of physicians' services, with particular emphasis on utilization fees and family income. The effects of utilization fees are studied by constructing point estimates of average expenditure for various classes of families. These estimates are extrapolated to yield estimates of expenditure in the absence of utilization fees.

The conclusions of the study are that utilization fees caused an overall reduction in expenditure of about six per cent. This reduction, however, was distributed unequally among families. Large families and families headed by the aged bore the brunt of the reductions in services. The income elasticity of demand for physicians' services is very small and declines over time.

ACKNOWLEDGEMENTS

This study would not have been possible or completed without the assistance of a number of organizations and individuals. The co-operation of the Medical Care Insurance Commission, the Saskatchewan Hospital Services Plan, and the Saskatchewan Treasury Branch in providing the data for the study is gratefully acknowledged. In addition, many individual members of the Medical Care Commission staff took an interest and assisted in the study. Mr. Ian Rogers, Executive Director of the Commission, Dr. David Penman, Director of the Medical Branch, and Mr. Bruce Lawson, Director of Claims read and commented on the entire manuscript.

Computer facilities were provided by the Saskatchewan Government Computer Centre and the University of Saskatchewan Computer Centre. Mrs. Uma Ganesan and Miss Elva Rode of the University Centre provided programming assistance and technical support for what at times seemed insurmountable problems. Mr. Floyd Vawter handled the computer operations in Regina.

Encouragement in the form of moral support and assistance was provided by my colleagues at the Department of Economics and Political Science, University of Saskatchewan. My original interest in economics was aroused by Professor George MacDowell, Brandon University, whose constant encouragement was a major factor in ensuring the completion of this dissertation.

The continued interest of my dissertation committee at the University of Alberta must be acknowledged. The committee, chaired by

Dr. E. J. Hanson, consisted of Drs. A. Buse, B. Wilkinson, C. Meilicke, and P. Ruderman (University of Toronto).

Financial support for the study was provided by the Department of National Health and Welfare, Ottawa.

The manuscript was typed by Mrs. A. Roberts.

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CHAPTER I

INTRODUCTION

In 1966 the Parliament of Canada enacted a statute which was designed to encourage the provision of pre-paid medical care to all residents of Canada.¹ Because of the constitutional allocation of powers, the Act was permissive, offering inducements in the form of financial assistance to the provinces to participate. It did, however, restrict the conditions under which grants would be offered. First, the provinces' medical care plans must be administered and operated by a public and non-profit authority. Second, the plan must provide medical services on uniform terms and conditions to all eligible residents of the province. Deterrents, contributions, or co-insurance charged must not preclude or impede reasonable access to services. Third, 90 per cent of a province's insurable residents must be covered during the first two years of operation, and thereafter 95 per cent must be covered. Finally, the provincial plans must provide for portability between provinces.

The Medical Care Act was the direct result of the Report of the Royal Commission on Health Services (the Hall Commission). The Commission, which reported in 1964, recommended "that as a nation we now take the necessary legislative, organizational and financial decisions to

¹Statutes of Canada, 1966, 14-15 Eliz. II, c. 64.

make all the fruits of the health sciences available to all our residents without hindrance of any kind."² To achieve this objective the Commission believed that a "comprehensive, universal Health Services Programme for the Canadian people" should focus on the provision of medical care through prepayment arrangements. The Programme prescribed the following essential characteristics:³

1. "Comprehensive"--includes all health services, preventative, diagnostic, curative and rehabilitative, that modern medical and other sciences can provide.
2. "Universal"--meaning that adequate health services shall be available to all Canadians wherever they reside and whatever their financial resources may be.
3. "Freedom of Choice"--meaning the right of a patient to select his physician or dentist and the right of the practitioner to accept or not to accept a patient except in emergency situations or on humanitarian grounds.
4. "Free and Self-governing Professions"--meaning the right of members of the health professions to practise within the law, to free choice of location and type of practice, and to professional self-government.

The inquiry of the Hall Commission was thorough; it revealed, however, that little objective information was available about many facets of health services. Indeed, the Commission noted that the "report falls short in many instances in establishing the facts. . . ."⁴ One of the factors responsible for this shortcoming is ". . . the absence of adequate historical and current data. . . ."⁵ This is particularly true in the case of universal prepayment for medical care on a fee-for-service basis. Experience of other countries was not

²Report of the Royal Commission on Health Services (Ottawa: Queen's Printer, 1964), I, 10.

³Ibid., p. 11.

⁴Ibid., p. 79.

⁵Ibid., p. 79.

considered particularly relevant; in some cases because of differences in the method of remuneration of physicians, and in other cases because of different social and institutional backgrounds. The Hall Commission, therefore, based its recommendation on observation of private and commercial prepayment and insurance schemes in Canada. Accordingly the Commission proclaimed: "We believe that the procedures for the provision of medical services in Canada established by those medical care prepayment plans operating on a 'service contract' basis have demonstrated their effectiveness and the possibility of low cost administration."⁶ The examination of the evolution of health insurance indicated that government-sponsored programs, such as hospital prepayment plans, had their early beginnings in private and voluntary schemes.⁷ It seemed natural, therefore, that government-sponsored prepayment schemes for medical care be developed.

There are difficulties in moving from private insurance to social insurance, particularly in the area of policy control. These difficulties arise from a difference in objectives. Private insurance is an institutional device for pooling definable risks in a large population. Insured individuals, or groups, contribute regular premiums which collectively provide a fund to compensate for losses. Since participation is voluntary, premiums generally approximate the individual's fair share of the risk. Premiums are, therefore, based on actuarial calculations of expected, or experienced, risk. Benefits are contractual. They may be in the form of money grants or services. The form

⁶Ibid., p. 29.

⁷Ibid., Chapter 10.

of the benefits also has implications for policy.

Provision of benefits through money grants to the insured, known as an indemnity contract, preceded service contracts in the health field.⁸ The function of the traditional indemnity contract was to provide against catastrophic loss. The contract between the insured and the insurer provides that the insurer reimburse the insured in the event of actual and necessary expenditure for insured services. The amount of such reimbursement is usually limited to some maximum amount or some portion of the expenses incurred. While this provision reduces the efficacy of such devices in providing coverage against risk of large expenditures, it is introduced to prevent excessive claims.

Service contracts, or prepayment contracts, are primarily concerned with the provision of medical care rather than risk aversion. The developers of such schemes viewed prepayment as a means of achieving a more adequate distribution of services.⁹ An additional and not inconsistent objective was that coverage be complete or comprehensive. Such contracts were at first commonly sought by unions through collective bargaining. A major impetus to the development of prepayment was the shift in policy of the medical associations that occurred in the 1930's.¹⁰ In response to popular demands for medical care insurance, the medical profession shifted from a position of opposition to the position that prepayment plans were acceptable if they were sponsored

⁸ Charles H. Berry, Voluntary Medical Insurance and Prepayment (Ottawa: Queen's Printer, 1964), p. 4.

⁹ Ibid., p. 5.

¹⁰ Odin W. Anderson, "Influence of Social and Economic Research on Public Policy in the Health Field," Milbank Memorial Fund Quarterly, Health Services Research 1, XLIV, No. 3 (July 1966), Part 2, 20.

by physicians or medical societies.

Social insurance, on the other hand, is a public means of pooling risks. Participation is usually compulsory. Contributions, either in the form of premiums or taxes, from, or on behalf of, those who are covered finance concurrent benefits. Because participation is compulsory, the premium need not be actuarially based. Experience of various groups in society may vary considerably. A uniform premium that is based on the experience of the society as a whole may therefore subsidize or penalize some groups. Thus some redistribution of income may be involved: "The term 'social' in social insurance implies that the welfare of the public or of particular social groups is given special consideration in determining premiums and in calculating benefits."¹¹ Benefits for programs in the health field, following the example of prepayment, are usually comprehensive.

The differences in the aims of private medical care insurance schemes and of social medical care insurance schemes are illustrated by some provisions of the private schemes. Private insurance schemes may employ a number of devices to reduce what they regard unnecessary utilization and abuse of insurance coverage. Included among such devices are: exclusions from coverage; waiting periods; pre-existing conditions; limits on the amount payable for any given claim or for any given time period; coinsurance and deductibles.

Some of these devices may not be used under social insurance because they are inconsistent with the objectives of the social insurance program. For example, exclusions in coverage, pre-existing conditions,

¹¹V. Carlson, Economic Security in the United States (New York: McGraw Hill, 1962), p. 5.

and limits on the amount payable are at variance with the desire to provide comprehensive medical care. On the other hand, however, if comprehensive coverage is provided "moral hazard" increases since exclusion in coverage is one of the ways of requiring ". . . that the event insured against be 'accidental' in the sense that the occurrence is beyond the control of the insured."¹² An alternative is to provide comprehensive coverage with coinsurance and/or deductibles. Coinsurance requires the individual to pay some part of the cost of all, or some, of the insured events. It is designed to ". . . maintain an economic interest on the part of the insured patient in the costs of care."¹³ A deductible excludes a certain amount of expense for specified claims from coverage. It is designed to eliminate small claims. A problem with the use of these devices under social insurance is that they may also unduly inhibit the use of services by some groups. The Hall Commission rejected the use of coinsurance on the grounds that "such a policy would mean that Canada was simply continuing to ration health services on the basis of ability to pay, a policy which was overwhelmingly denounced in submissions to the Commission."¹⁴ Lack of data has hitherto made it impossible to determine whether or not coinsurance or deductibles are effective in limiting expenditures for health care. In addition, there is the question whether they so limit the provision of health services as to defeat the goal of a public medical care

¹²Irving Pfeffle, Insurance and Economic Theory (Homewood, Ill.: Richard D. Irwin Inc., 1956), p. 62. Moral hazard is defined as the increased propensity to incur expenditures when covered by insurance.

¹³O. D. Dickerson, Health Insurance (Homewood, Ill.: Richard D. Irwin Inc., 3rd ed., 1968), p. 398.

¹⁴Hall Commission, op. cit., II, 6.

insurance program. These devices, however, are commonly employed in private insurance and prepayment schemes under the belief that they are effective. As one writer recently stated: "Few contentions are as firmly established in contemporary insurance thought as the one which holds that a deductible provision in an automobile insurance policy serves as a major safeguard against moral hazard."¹⁵ In the health context another writer observed: "It is interesting to note the almost universal intuitive feeling of experts and laymen alike that a deductible will reduce utilization. Nearly as universal, however, is the absence of data to support such a conclusion."¹⁶ The Hall Commission weighed heavily the views of a man experienced with medical care prepayment plans:

We have in the medical profession today an opinion that the cure of over-utilization in prepaid comprehensive care is a combination of deterrents, deductibles and co-insurance now given the sophisticated name of patient participation. It appears to me that the basis of this opinion is purely impressions [sic]. I know of no published work either in Canada or the United States which would indicate that patient participation has any worthwhile influence on utilization. We are told it has, but I have yet to see a study that would substantiate such an impression.¹⁷

The Commission's rejection of the use of patient participation in prepayment was based on an a priori argument.

The problems of trying to devise means of controlling expenditures under public medical care insurance, therefore, are doubly

¹⁵Richard F. Schmidt, "Does a Deductible Curb Moral Hazard," Journal of Insurance, American Risk and Insurance Association, XXVIII, No. 3 (Sept. 1961), 89.

¹⁶Charles P. Hall Jr., "Deductibles in Health Insurance: An Evaluation," Journal of Risk and Insurance, XXXIII, (June 1966), 257.

¹⁷Dr. W. B. Stiver, Medical Director of Physicians' Services Inc., Toronto, as quoted in the Hall Commission, II, 5.

difficult. The objectives of public programs are more demanding than those private programs with which we have had experience, rendering the data provided by those programs less instructive. In addition, the philosophical framework adopted by the government (in accordance with the recommendations of the Hall Commission) does not include automatic checks and balances that are ordinarily part of a market system. The Health Services Programme, the Commission suggested, should be dedicated to providing the highest possible quality of care: "We consider quality as the most essential element in health services and every aspect of the programmes must be constantly directed to that end."¹⁸ Further they argue ". . . that from first to last, quality of service rests in the hands of the medical profession. . . ." ¹⁹ This has profound implications when combined with a program which attempts to remove income as a constraint on utilization. The only criterion in this system for deciding whether expenditures on services are justified is whether or not those services represent quality care. The objective of maximizing the quality of health services provides no guidance in a system that is constrained by scarce resources. No meaningful operational priorities are offered as to what type of care is to be provided; nor are there any inherent forces causing a search for alternative ways of producing health care. In other words, the provision problem is stressed to the extent that the allocation problem is completely ignored. The situation may be illustrated on the production side by the case of laboratory procedures. A wide variety of elective labora-

¹⁸Hall Commission, op. cit., II, 1.

¹⁹Ibid., p. 2.

tory tests may be performed. The question is which are adequate for quality care. One study of a Chicago hospital where patients, upon admission, were automatically provided with urinalysis, fasting blood glucose, and hemoglobin tests revealed that in the cases with abnormal results, only 16 per cent of those tests were considered, or even seen, by the doctors. Further, in only 5 per cent of such cases did the doctor react in a way consistent with "quality" care.²⁰ There is, therefore, considerable substitutability in the production of medical care. The maximizing dictum seems something less than an "invisible hand" guiding the provision of medical care. When the guiding rule is taken to be "the best possible care" the checks and balances of a market mechanism are lost, and there is no basis for allocative decisions. We have in effect a common economy commanded by those who can identify "quality care."

In view of the difficulty of measuring the quality of care, and the unwillingness in some quarters to have it measured, it is not surprising that those in charge of public policy are concerned about the rising costs of medical care. Writing about the issues in public medical care programs, the late chairman of the Saskatchewan Advisory Planning Committee for Medical Care observed: "Probably the decisive factors would be the total cost of the program and how much the public

²⁰ John W. Williamson, Marshall Alexander, and George E. Miller, "Continuing Education and Patient Care Research," Journal of American Medical Association, CCI (Sept. 1967), 938-942.

is prepared to pay for that program in the form of taxes."²¹ Thus there is another dimension to the problem of overutilization, namely how much utilization the public is willing to pay for.

These problems of predicting and controlling costs of medical care resulted in a delay in the implementation of the federal medical care program and also reluctance on the part of the provinces to enter the scheme. The federal Medical Care Act was passed in 1966 but was not implemented until July 1, 1968.

Inducements to participate in the federal medical care scheme are very strong. The federal government grants to qualifying provinces an amount per beneficiary equal to 50 per cent of the national per capita costs in participating provinces. Symbolically, if we denote X_i as total expenditure for medical care in the i th participating province and N_i as the covered population for that province, the federal grant is

$$\left[\frac{\sum X_i}{2 \sum N_i} \right] N_i$$

A province having a per capita cost equal to the national average would receive a grant equal to fifty percent of its expenditures for insured services. Provinces having per capita costs greater than the national average would receive less than one half of their expenditures for

²¹W. P. Thompson, Medical Care: Programs and Issues (Toronto: Clarke, Irwin and Company, Ltd., 1964), p. 107. Also see, James M. Buchanan, "The Inconsistencies of the National Health Service," Institute of Economic Affairs (London, 1965) Occasional Paper 7, for the argument that utilization as expressed through private or individual choice may exceed the willingness of the public to provide as voters-taxpayers.

insured services. The converse is true for those with lower per capita costs. Thus the formula for federal grants not only encourages participation in the medical care program but also may involve some redistribution of income. This was one of the reasons for hesitancy on the part of some provinces in joining the scheme.²²

A more important reason the provinces were reluctant to participate in the plan, however, was their fear that a medical care insurance scheme would involve a large and growing demand on their treasuries. Indeed, the federal government itself believed that additional expenditures were involved in medicare and therefore delayed implementation of the plan for a year.²³ Ostensibly the reason was that the anticipated increase in expenditures under medical care would aggravate an economy already suffering from inflationary pressures. In arguing for the delay, the Minister of Finance stated: "The government has no intention of changing the substance of the bill other than its effective date."²⁴ The federal government obviously believed that medical care insurance, by reducing the income barrier, would result in increased expenditures for medical care. As noted above, firm estimates of the effect of medical care insurance on expenditures for services were not available.

The cost question was further complicated by the nature of the grant formula. The federal grant is tied to the per capita cost of participating provinces. Not only were reliable estimates of per

²² Only Saskatchewan and British Columbia joined the plan on July 1, 1968; Manitoba and Nova Scotia joined on April 1, 1969, and Alberta on July 1, 1969.

²³ Implementation of the Plan was changed from July 1, 1967 to July 1, 1968 while the bill was still before the House of Commons.

²⁴ Mitchell Sharp, Minister of Finance, Hansard, Sept. 8, 1966, 8217.

capita costs for the provinces lacking but also the number of provinces participating was unknown. Thus, the provinces could not make reliable estimates of the federal grant as a share of the costs they anticipated.

The other aspect of costs, and the one most significant for this study, was the potential growth of costs in the future. The provinces feared that they were being encouraged into a public program which has "enormous built-in growth factors."²⁵ No empirical studies provided by the Hall Commission suggested how expenditures under such a program might be regulated by public policy. Moreover, the very premise upon which the plan was based, namely quality care, seemed to preclude such control. Thus, some of the provinces saw themselves getting into a public program whose initial costs were unknown and whose future costs were, it was feared, uncontrollable. They proposed as an alternative a subsidized premium scheme whereby the government would pay the premium for low income groups and the needy. Several of the provinces already had such plans and asked that they be approved for the federal grant. Under such a system it would be possible for the schemes to be operated as private plans and thus be open to a wider range of controls. The Premiers of Ontario and Alberta were particularly vociferous in making such demands. By 1970, however, all provinces had joined the federal medical care scheme, though concern over cost control has continued. A federal-provincial health ministers' conference was convened in Ottawa in November, 1969 to ". . . try to curb spending without injuring services."²⁶

²⁵ Editorial, The Globe and Mail (Toronto), May 1, 1969.

²⁶ Canadian Press story in the Leader Post (Regina), November 19, 1969.

At the time the federal legislation was being discussed, potential participants in the medical care plan could find little comfort in statements of public policy emanating from the Province of Saskatchewan. The Province of Saskatchewan put into effect North America's first universal comprehensive public medical care insurance scheme on July 1, 1962.²⁷ The framework and philosophy of the scheme corresponded to those recommended later by the Hall Commission. In 1967, after about five years of continuous operation of the province's medical care plan, the Premier of Saskatchewan began to voice growing concern over the rate of increase in health expenditures: "The doctors want three or four million more, the nurses another two million and the hospital boards are all hollering. Why the increased cost of medicare alone is now more than the total cost in its first full year of operation."²⁸ In 1968 Saskatchewan introduced a utilization fee. Beginning April 15 of that year physicians were allowed to charge the patient a fee of \$1.50 per office visit and \$2.00 for a home, emergency or hospital out-patient visit. These amounts were deducted from payments made to physicians for insured services.

The Saskatchewan utilization fee appears to have been introduced with the same informational background as the Hall Commission's Health Services Programme; an obvious lack of "hard data" relating to the

²⁷ Statutes of Saskatchewan, 1961 (2nd Sess.), c. 1, s. 8.

²⁸ W. Ross Thatcher, as quoted in Star-Phoenix (Saskatoon), November 4, 1967, p. 3. Negotiations were in progress with both the doctors and the nurses for a change in fees and salaries. The cost of the Medical Care Insurance Plan in its first full year of operation (1963) was \$18.3 million; the increase from 1966 to 1967 was \$1.18 million. Mr. Thatcher subsequently repeatedly characterized the rate of increase of health expenditures as "unbelievable".

efficacy of such policies. Repeated opposition requests for documentation of the case for utilization fees were ignored. The absence of such studies has been noted above.

At the time research studies were being prepared for the Hall Commission, the Saskatchewan plan had been in operation only one year. Experience under the plan was not very instructive other than yielding some estimates of per capita cost.²⁹ The plan, however, has now been in continuous operation for seven full years. In addition, there have been few changes in coverage. Remuneration to physicians is on a fee-for-service basis. Records are kept of all claims for services to beneficiaries. Thus there now exists a considerable amount of data on utilization of services by beneficiaries.

The Saskatchewan experience is also important because of the introduction of the utilization fee. Per capita expenditures for physicians' services had increased under the plan at an annual rate of about 4.8 per cent prior to the introduction of the utilization fee. In the calendar year after the introduction of the fee, per capita expenditures dropped by about 4.5 percent. If the utilization fee can be regarded as an increase in the price of physicians' services, this experience would suggest that the demand for such services is price elastic, i.e., the quantity demanded decreased more than proportionately than the increased price.³⁰ This is not what one would expect on a priori grounds, nor is it consistent with the results of some of the empirical work on the price elasticity of demand for medical care. For

²⁹Charles H. Berry, op. cit., pp. 162-166.

³⁰The proportion of price change cannot, of course, be determined.

example, using cross sectional data for American families in 1953 and 1958, Feldstein and Severson estimated a price elasticity of demand for physicians' services of 0.2.³¹ While the utilization fee was hailed as successful because of the reduction in consumption, an assessment of the effects of raising a price in a market must go beyond simply observing the extent to which quantity demanded is inversely related to price. Other factors such as changes in income, changes in the fees paid to doctors, changes in population, etc., must be examined. Also the impact on various population groups must be determined. If the differential effect is great enough the policy may well thwart the original intentions of the public medical care plan. If medical care services are not provided on a uniform basis to all of its citizens, a province may not qualify under the federal plan for a grant. The fact that a utilization fee was introduced, however, does enrich the Saskatchewan data as a source for studying the factors that influence family expenditures for medical care.

³¹P. J. Feldstein and R. M. Severson, "The Demand for Medical Care," in Report of the Commission on the Cost of Medical Care (Chicago: American Medical Association, 1964), I, 66. Other studies of income and price elasticity of demand for medical services include: O. W. Anderson, P. Collette, and J. J. Feldman, Changes in Family Medical Care Expenditures and Voluntary Health Insurance (Cambridge, Mass.: Harvard University Press, 1963); M. Friedman and S. Kuznets, Income from Independent Professional Practice (New York: National Bureau of Economic Research, 1945); G. J. Stigler, Trends in Employment in Service Industries (Princeton: Princeton University Press, 1956); L. J. Paradiso and C. Winston, "Consumer Expenditure Income Patterns," Survey of Current Business, IIIIV, No. 5 (Sept. 1955), 23-32; H. I. Greenfield, "Medical Care in the United States: an Economic Work-up," paper given at Annual Meeting of American Association for Advancement of Science, Cleveland, December 26, 1953.

Summary

Canada has taken a major step in the promotion of public prepaid medical care insurance. This step was taken in the face of many questions to which no answer could be given. For example, does medical care insurance remove income as a constraining variable on family expenditure for medical care? Does such a program mean that physicians' services are provided on a uniform basis to all? To the extent that medical care insurance does remove the income barrier, does this imply that expenditures for medical services will increase? That is, do family expenditures tend toward some norm, and, if so, how long does it take to reach such a plateau? And finally, is a utilization fee an acceptable means of controlling expenditures for medical services? To what extent does the introduction of such a fee imply that physicians' services will be allocated on the basis of ability to pay?

The Saskatchewan medical care insurance scheme provides data that may be used, it is hoped, to answer these questions. The fact that a utilization fee was introduced makes a study of Saskatchewan families' medical care utilization even more relevant. Accordingly this thesis has two principal objectives. First, some "hard data" relating to the actual expenditures by Saskatchewan families on physicians' services will be collected. An attempt will be made to compile the data in such a way that it may be assembled to yield more detailed information on family medical care expenditures than has previously been available. The data is recorded by an agency which has as its primary function the administration of the medical care plan. Information is not necessarily recorded in a manner suited to research.

Some adjustments, therefore, are required. Second, quantitative estimates of the effects of income and utilization fees on family expenditures for medical care will be made. The information available is much broader than simply medical expenditure and income. Records include such information as age, marital status, sex, family size, and location. This information will be included in the analysis. These estimates will provide a background against which a number of policy questions regarding public medical care insurance schemes may, it is hoped, be examined.

The outline of the study is as follows. Chapter Two will describe the Saskatchewan setting and data sources. Changes in the operation of the agencies which provide the data will be examined as they affect the data. Chapter Three will explain the methods used to collect the data. Also, the nature and representativeness of the sample will be discussed. Chapter Four will describe the analytical model that will be employed. Chapter Five will present a cross section analysis of family medical expenditure. This will be done for each of the years for which reliable data is available. Chapter Six will present an analysis of the effect of utilization fees on family utilization of medical services. Chapter Seven will contain a summary and the conclusions of the study.

CHAPTER II

THE AGENCIES, THEIR INFORMATION, AND THE QUALITY OF THE DATA

The purposes of this chapter are: (a) to present the information available for use in this study; (b) to explain how that information is collected and recorded by the different agencies; (c) to examine Saskatchewan's Hospital Services Plan and its Medical Care Insurance Plan and the changes in those plans; and (d) to describe the characteristics of the population and the demographic changes which may have relevance for the analysis of the behaviour of family expenditures on physicians' services. The analysis of the characteristics of the population will, it is hoped, provide a background to permit the relevance of the study and its generality to be assessed.

Three agencies have provided the data for this study. They will be examined and their methods of collecting and recording data will be explained. The Saskatchewan Hospital Services Plan has been given priority of treatment, since some of its definitions of recipients of benefits and its methods of recording data were adopted by the Medical Care Insurance Commission, when the latter was established some fourteen years later. The records of the Saskatchewan Hospital Services Plan thus had the greatest effect on the procedures used in this study to compile the sample and to test its validity. The expenditures on medical care, drawn from the records of the Medical

Care Insurance Commission, and the income data, drawn from the records of the Saskatchewan Treasury Department, however, constitute the subject matter of the analysis.

The Saskatchewan Hospital Services Plan (SHSP)

The SHSP began operations on January 1, 1947.¹ Its original purpose was to provide universal public insurance for all costs ordinarily incurred by in-patients.² All persons who have resided in the province for three months are required to participate in the Plan, with the exception of those covered by federal programs. Eligibility for benefits depends upon the prior payment of a personal tax, levied annually on a family basis.

It is the tax collection responsibilities of the Plan that we are concerned with, for they required that all beneficiaries be identified and, as noted above, the identification scheme developed for the hospital plan was later adopted by the medical care plan. The identification records, however, continued to be held and serviced by the hospital plan. Since these records constitute the list of beneficiaries, or the population list, for the medical care plan, their characteristics are examined and explained.

Since the hospital tax or premium was levied on "families," "families" had to be defined and distinguished, and beneficiaries in each such family identified. A family is defined to consist of a self-supporting person of any age together with his spouse or dependents

¹Statutes of Saskatchewan, 1946, c. 82, s. 3.

²In-patients as distinct from out-patients are those patients receiving the services of a hospital while occupying a bed overnight.

under eighteen years of age. A single person over eighteen years of age (whether self-supporting or not) is also considered to be a family.³ An eight digit identification number was assigned upon registration to all individuals eligible for coverage under the plan. Figure 2.1 illustrates the assignment for a given family. The first six digits identify the family and the remaining two digits refer to individual members of that family. All individuals, identified by an eight digit number, are listed in a Master Registration File. In addition, a "family record," indicating location and family size, precedes the records of the family beneficiaries in the Master Registration File.⁴

The beneficiary record in the Master Registration File not only identifies each individual, but it also contains such other information as age, sex, and marital status, necessary to determine eligibility under the plan.⁵ The "activity status" indicates eligibility for benefits. If people die or leave the province, their status becomes "inactive." The "coverage entries" indicate who is responsible for payment of the tax, and the dates for which taxes have been paid. People on welfare, for example, are not responsible for the payment of their premium.

The number of families in the population increases over time as new families enter the province and as individual members of a

³This is the definition of a family that prevails for the period since the Medical Care Plan was introduced. See Medical Care Insurance Commission, Annual Report 1968 (Regina: Queen's Printer, 1968), p. 36.

⁴The term "record" is used in this study to refer to a logical set of data.

⁵See Appendix B for a list of the variables included in the beneficiary record.

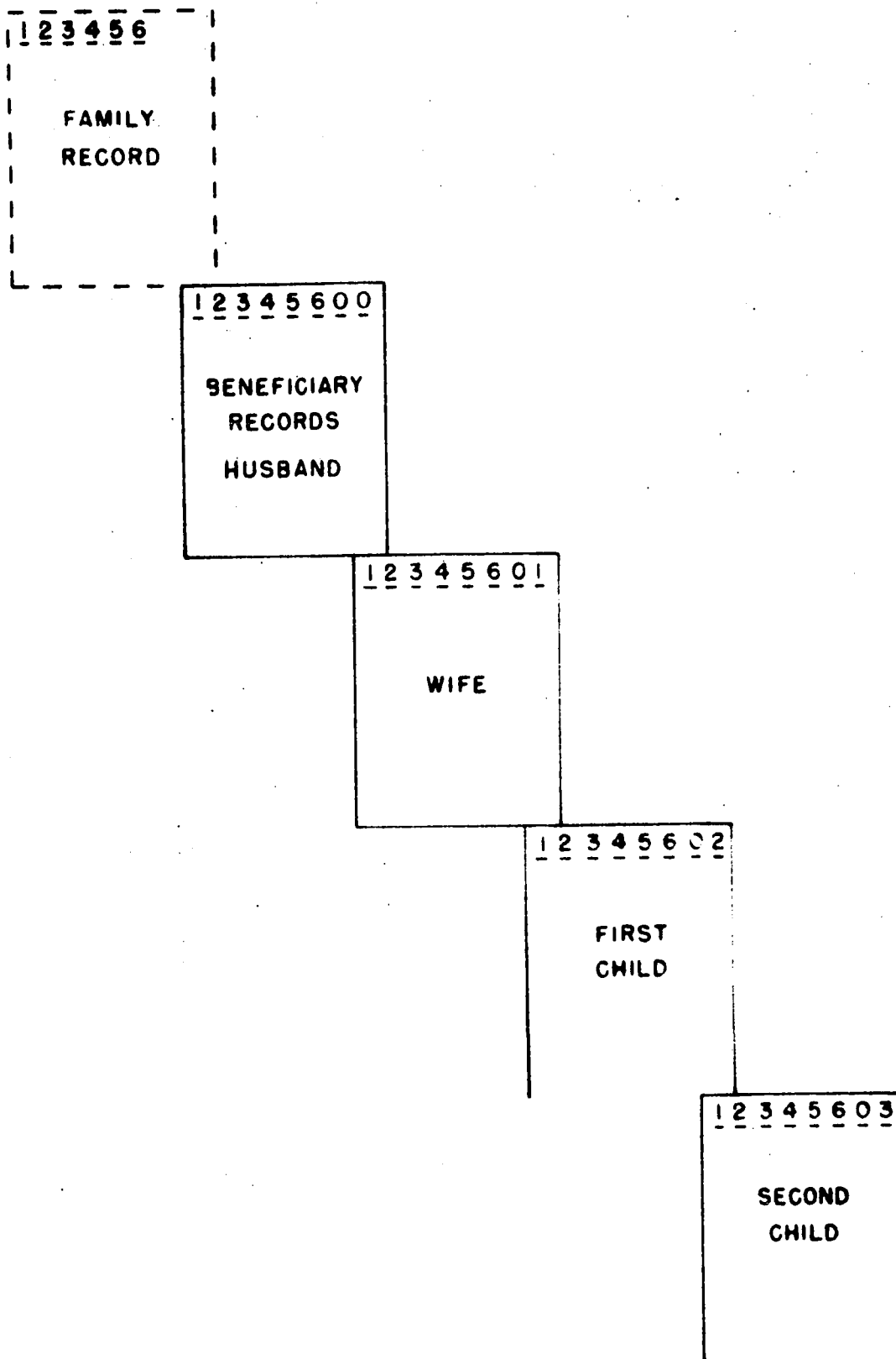


FIGURE 2.1. MASTER REGISTRATION FILE FORMAT

current family reach eighteen years of age thus becoming, by definition, separate families. It is obvious in the latter case, of course, that an individual, over a period of time, may have several identification numbers. Figure 2.2 illustrates the case of a girl who reaches age eighteen and later marries. On reaching eighteen, the girl gives up the beneficiary number she held as a dependent and is assigned a new number. She has become, by definition, a "family." If she marries, she will become a dependent in another family, and her identification number changes to her husband's family number with the appropriate beneficiary number. In each of the above circumstances the "coverage entries" in the respective beneficiary records will indicate the time periods during which the girl was eligible for services under each of the beneficiary numbers.

The possibility of a given individual having several identification numbers introduces the necessity of a system of cross referencing. For this purpose information referring to an "other number" is also included in the beneficiary record. An indicator also identifies the "other number" as an old number or a new number. In the example described above, the number cross referencing is also shown in Figure 2.2. The girl who attained the age of eighteen received a new identification number. Her original number, therefore, contains an entry indicating her "other number" and that it is "new." Her new number (as a single girl) would contain (had she not yet married as in our example) an entry showing her original number and that it is "old." Once she marries, she again receives a new number and her single record is changed to refer to her married number. Her married record will refer back only to her single record. A limitation,

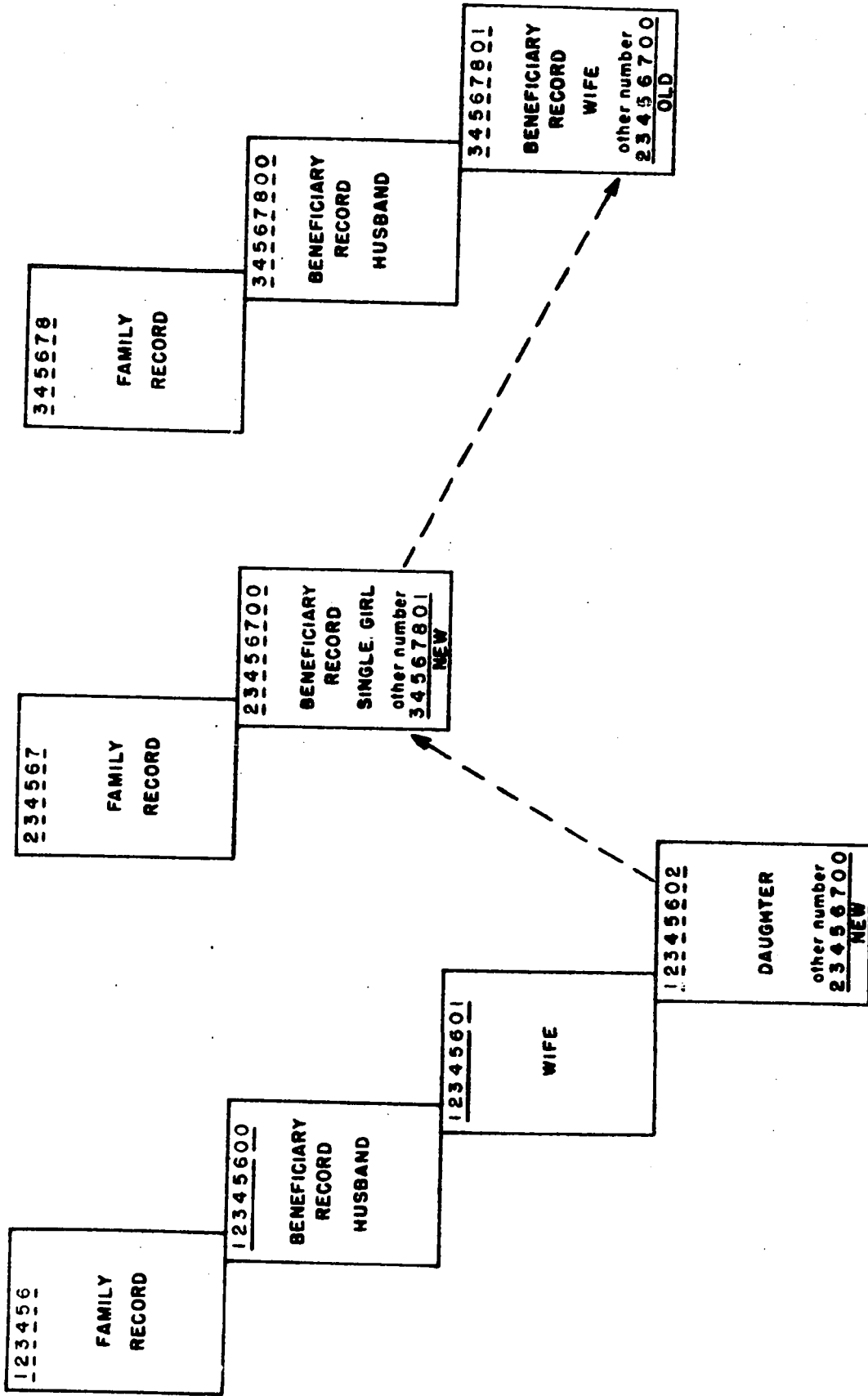


FIGURE 2.2. CROSS REFERENCING IN MASTER REGISTRATION FILE

therefore, on the scheme of cross referencing is that it refers forward but not backward. That is, if we began with the married (single) record we could trace back (forward) only to the single (married) record: only if we began with the original record could we identify all the numbers that had been assigned to the individual. The problems that this posed for data collection will be discussed later.

In summary, the SHSP maintains a Master Registration File which is a list of all individuals who are eligible for coverage under the hospitalization plan. The system of beneficiary identification involves a specific definition of the term "family." Since the medical care program employs the same identification system, the Master Registration File also serves as a population list for that program, and the same definition of a family is imposed on the medical care data.

The Saskatchewan Medical Care Insurance Plan (MCIC)

The Saskatchewan Medical Care Insurance Plan is a universal comprehensive scheme for public insurance and provision of coverage for virtually all physicians' services.⁶ Under the Saskatchewan Medical Care Insurance Act of 1961, the Plan is administered by an independent commission reporting to the Minister of Health. Members of the commission are appointed by the Lieutenant Governor in Council, ordinarily for three-year terms. The College of Physicians and Surgeons of Saskatchewan nominates some members to the Commission. Powers are delegated under the Act to both the Lieutenant Governor in Council and the Commission. The former is responsible for matters relating to coverage, financing and methods of premium collection;

⁶Statutes of Saskatchewan, 1961 (2nd Sess.), c. 1, s. 8.

the latter for arrangements to pay for insured services, rates of payment, and assessment of accounts.⁷

The eligibility requirements of the Medical Care Plan are virtually identical with those of the Hospital Services Plan. Eligibility for benefits depends upon the prior payment of a personal tax levied quarterly or annually on a family basis. Since the SHSP had already established a beneficiary identification system at the time of the inception of the Medical Care Plan, that system was adopted for purposes of premium collection and billing for services rendered. The premium is now collected jointly with the hospitalization tax.

The Medical Care Plan provides universal coverage. Only those covered under federal programs and the residents of the Swift Current Health Region are exempt from services and from tax.⁸ Those covered by other provincial or municipal programs, such as the Saskatchewan Assistance Plan, are not required to pay their own tax or premium. Services covered under the plan are subject to the general limitation that the services insured must be provided, or authorized by, a legally qualified medical practitioner. There are few specific limitations on coverage. In general, services covered under other federal or provincial programs, such as Cancer and Workmen's Compensation, and services for which there is third party liability, are excluded. For residents who incur expenses outside the province, all services provided by the Plan are insured, although at rates payable in Saskatchewan.

⁷Commission regulations are subject to the approval of the Lieutenant Governor in Council.

⁸The Swift Current Health Region had, at the time of the introduction of the Medical Care Plan, its own municipal plan and was allowed to continue that plan.

Since the inception of the plan, there have been very few changes in coverage. In 1963 the Act was amended to include diagnostic x-ray and laboratory services provided in non-hospital facilities, and an extended list of laboratory services provided in the office of a physician. In 1965 out-of-province non-emergency psychiatric care became an insured service. Furthermore, physicians' mileage and the services of physiotherapists ceased to be benefits. In 1968, eye examinations to determine refractive error were included when provided by a physician. Later in that year coverage was extended to include such services when provided by an optometrist.

In addition to these changes in coverage, some changes occurred through changes in assessment rules under the discretion given the Commission by the Act. Prior to July 1, 1968 the Commission, for the most part, relied on the preamble of the Fee Schedule to provide a statement of definitions. For various aspects of the services provided, those assessment rules, with few exceptions, have remained unchanged.⁹ Following the revision of the Fee Schedule in 1968, the assessment rules were written up separately, since the preamble of the new Schedule did not meet with Commission approval. Some changes in the assessment rules were introduced at this time. These changes will be discussed later, along with a discussion of the revision of the Fee Schedule.

The financial aspects of the plan from the supply side are that services are to be paid for on a fee-for-service basis. The 1959 Minimum Schedule of Fees of the Saskatchewan College of Physicians and Surgeons (as amended to March 15, 1962) listed the rates to be paid for

⁹Interview with Mr. I. Rogers, Executive Director of the Medical Care Insurance Commission, March 18, 1970.

various services. This structure of fees prevailed, other than for changes in interpretation mentioned above, from 1962 to August, 1968. The level of payment was set at 85 per cent of the rate specified in the Fee Schedule. But for the period November 1967 to August 1968 the level of payment for visits only was raised to 95 per cent as an interim measure while discussions about a revision of the Fee Schedule were going on. A revised Fee Schedule was adopted and took effect on August 1, 1968.¹⁰

The billing for services rendered may be done in three ways. The physician may submit his bill directly to the Commission and accept their payment as payment in full.¹¹ Or he may submit the bill directly to the patient for payment. In this case the physician is free to determine the rate. The patient may in turn submit the bill to the Commission and receive the appropriate proportion of the amount payable under the Fee Schedule.¹² Or the physician, if he is a member, may submit his bills to an "approved health agency," for those patients who are subscribers.¹³ The agency then submits the bill to the Commission, receives payment at the appropriate rate, and forwards this payment to the physician. In 1969, 49 per cent of the claims received

¹⁰The new edition of the Fee Schedule, called the centennial version, provided for an average increase in fees of 20 per cent. See Saskatchewan Medical Care Insurance Commission, Annual Report 1969 (Regina: Queen's Printer, 1969), p. 24.

¹¹There are some authorized charges that may occur, such as extra charges for specialists' services when the patient has not been referred and, of course, utilization fees.

¹²In practice, the physician usually submits a copy of his bill to the Commission on the patient's behalf.

¹³An "approved health agency" is a health agency designated by order of the Lieutenant Governor in Council as an approved health agency.

by the Commission were received directly from the providers of service, 44.5 per cent were received through approved health agencies, and 6.5 per cent from beneficiaries.¹⁴

Direct charges, other than authorized charges, are paid by the patient for services only when the physician bills the patient directly. However, in April 1968 a "utilization fee" was introduced which the physician could charge for certain services.¹⁵ An amount equal to \$1.50 for office visits and \$2.00 for home, emergency or hospital outpatient visits is deducted from the payment to physicians for those services. The physician is permitted to recover this amount in the form of a direct charge from the patient.¹⁶ Thus the possibility of a further direct charge was introduced.

The Assessment and Processing of Claims

In the course of processing bills for physicians' services the Claims Branch of the Medical Care Insurance Commission compiles claims records. These records are identified by the registration number of the beneficiary. The collection of all claims for a given beneficiary is called the claims history and these are stored sequentially by registration number in a Patient History File. This file contains claims only and does not have records for any beneficiaries without claims experience.

¹⁴Annual Report 1969, op. cit., p. 25.

¹⁵Order in Council, Number 613168, April 11, 1968.

¹⁶The Saskatchewan Medical Association mailed a questionnaire to physicians. In response to a question about the collection of the utilization fee only 9 out of 226 said they always collected the fee.

Each claims record contains the following information: the patient's identification number; the physician's identification number and his specialty, if any; the clinic number; a referring physician's identification number, if applicable; the method of billing, and information relating to the nature of the claim. Included in the latter are the dates of service, the diagnosis, the Fee Schedule code, the fee submitted, and the fee that is approved for payment after assessment.¹⁷

The methods used in assessing claims are of special significance when considering the reliability of the data. Claims are submitted to the Commission by the physician on specially prepared forms. Upon receipt at the Commission, the claim is translated into machine accessible form. The claim then goes through a series of programmed and manual checks. First, of course, the record is scanned for keypunch errors. Then the claim is processed by the "Identity Program." The program compares all of the information on the claim relating to the patient's identity with the corresponding information on the Master Registration File. In addition, the Master Registration File information on coverage is checked to determine if the patient is eligible for services.

About 4.0 per cent of the weekly batch of claims require manual attention owing to identity problems. The Identity Program was introduced in 1965. Prior to this the identification check was based on a comparison with the previous claim under a given identification number on the Patient History File. That is, the identification of a given

¹⁷ See Appendix B for a full description of the claims record.

beneficiary was established by the particulars submitted on the first claim for payment. All subsequent claims for that beneficiary would then be checked for identification against the previous claim. This meant that different claims for one individual might possibly be recorded as payments on behalf of another. Also, since "other numbers" were not cross-referenced, it was possible for a given person to be treated as two separate people, i.e., to have two concurrent identification numbers. This system was replaced in 1965 by the present system which checks all claims against the Master Registration File which is an independently compiled file. Upon introduction of the new identification validation scheme, the Commission compared all claims on the Patient History File with the Master Registration File to verify the patient identification. Identification errors on the Patient History File were corrected with the exception of a small number of cases where the beneficiary had died or left the province and it was not possible to get the required information. Thus, while the identification checking system employed prior to 1965 allowed the possibility of error in compiling histories of service to beneficiaries (although not in payment of a claim) the considerable effort expended to "cleanse" the Patient History File would suggest that the recorded histories are reasonably comparable over time.

Next the claim is processed by the "Edit Program."¹⁸ This program compares all of the information on the claims record relating

¹⁸This is not the order of actual processing. In fact, the claims cards are read in at this point so the Edit procedure actually precedes the Identity Program in the physical processing.

to the identity of the physician with the Physician File.¹⁹ To be eligible for payment for services rendered, the physician must be a participating member of the plan. The specialty of the physician is examined also along with the information on the fee and the Fee Schedule code submitted. Among the criteria considered are whether or not the physician is a specialist, whether or not the patient was referred, and the age of the patient for services that have different fees for adults and children. If there are any irregularities in any of this information, the claim may be adjusted or selected for manual review. The major portion of the cases for manual review involve questions concerning the relationship of one service to another on the same claim or on a previously paid claim. Where medical judgment is required the claim is referred to the Medical Branch. In cases where a claim is adjusted either by the program or manually, an explanation is given the physician by way of an "explanatory code." Each physician has a list of the explanations for each value of the code.

Third, the claim is processed by an "Assessment Program." This program compares the medical aspect of the claim with the patient's previous medical history. A number of checks are included. Indeed, over two hundred assessment rules are built into this program. Among the more routine items turning up are duplicate claims, claims for services which are included in a composite fee, i.e., services following surgery, or claims for composite fee services where more than one physician is involved. Claims that do not pass the assessment program are selected for manual review. Again, in instances calling for medical

¹⁹The Patient History File is a list of all physicians and their particulars who are eligible to receive payment for services under the plan.

judgment, the claim is referred to the Medical Branch. Claims automatically approved or adjusted and approved are passed on to the payments program.

The final processing stage is the "Payment Program." Detailed physician payment lists are printed listing the patients alphabetically by surname with the date of service, fee schedule code and fee, the utilization fee and an explanatory code for any adjustments made to the fee. When payment is made to the beneficiary a separate cheque is prepared for each claim and the details of the payment are explained on the cheque stub.

The complete processing procedure is repeated weekly on a volume of about 70,000 claims. About 80 per cent of the claims receive routine approval. The remaining 20 per cent are reviewed manually and reprocessed with approximately 4 per cent of the claims being returned to the sender for further information. The thoroughness of the entire procedure would suggest a high degree of uniformity in the nature of the claims data.

Other Claims Review Procedures

There are a number of general and specific programs designed to evaluate the flow of claims over time. Quarterly statistical reports are produced on a number of variables relating to the type of claim by Fee Schedule code, the number of claim adjustments by code type, payments by type of physician specialty, etc. In addition, the Payments Division sends out questionnaires every second month to individual beneficiaries on a sampling basis. These questionnaires seek to verify the receipt of services for which a claim has been paid.

Where disagreements occur they are communicated to the relevant parties and are corrected if the nature of the error is agreed upon. Lasting disagreements are referred to the Medical Branch.

In addition to the computerized "general verification," referred to above, there are "special verification" programs which focus on specific kinds of services or specific locations.

A general program for evaluating the flow of claims involves an assessment of the activities of participating physicians. "Physician profiles" are prepared, based upon the services rendered by physicians over a period of time, either quarterly or yearly. The "profile" of an individual physician presents information on his activities, some--such as the average cost per patient--in absolute terms; others--such as the ratio of complete examinations to office visits--in relative terms. Each profile also contains the averages for the same information for a peer group of physicians. Thus a comparison of the activities of each physician with those of his peer group can be made. If the performance of a physician deviates by more than two standard deviations from the average for the peer group, his record is sent to the Professional Review Committee of the College of Physicians and Surgeons for review.

When the profile system was being discussed and developed, the Commission proposed setting up its own review committee to evaluate the implications of a physician's deviation from the statistical norm. The College of Physicians and Surgeons, stressing its own interest in quality care, expressed strong reservations about a committee so

constituted.²⁰ It proposed setting up a committee of the College, known as the Professional Review Committee, to study, analyze, and investigate patterns of professional practice. Beginning in the last quarter of 1964, physician profiles were referred to the College of Physicians and Surgeons. The Professional Review Committee of the College studies the referred profiles and makes recommendations to the College. The College, on hearing the advice of the Committee, may then make some recommendation to the Commission for remedial action.

The effect of the introduction of the physician profile system on the flow of claims for services is difficult to evaluate. In the early years of its operation, adjustments of some accounts were recommended by the College upon review of the profiles referred to its committee. Recently, however, it is claimed that the profile review procedure is becoming progressively less effective.²¹ On the other hand, the Saskatchewan Medical Association, in a news release, have contended that the assessment procedures introduced by the Commission are so rigorous and are applied with such zeal as to constitute "harrassment" of the profession.²² The fact that 80 per cent of the claims are assessed automatically by a computer would suggest that these arguments refer to manual assessments. Of the cases referred to the Professional Review Committee in 1967, 1968 and

²⁰ Saskatchewan College of Physicians and Surgeons, Newsletter, January 27, 1964.

²¹ D. Penman, Director of the Medical Branch, Medical Care Insurance Commission, in a paper delivered to Seminar on Research on Health Care in Saskatchewan, November 21, 1969, Saskatoon.

²² Star-Phoenix (Saskatoon), April 7, 1970, p. 3.

1969 none resulted in a recommendation from the College to the Commission for action.²³ Perhaps the real value of the physician profile system lies in the compilation and known existence of the records rather than in their actual use. If, however, instruments designed to evaluate performance (or, indeed, to enforce laws) are not used, their "threat" value diminishes.

In addition to these established practices to identify claims and to examine their validity, special studies are, from time to time, undertaken by the Research Branch of the Commission. The Research Branch was established in 1964. Besides carrying on studies of its own, the Research Branch provides a liason for independent researchers studying matters of mutual interest.

Summary

As has been shown, the Commission expends considerable effort to ensure the validity and consistency of the claims data. The introduction of the patient identity check in 1965 was a significant step in improving the quality of the claims data. The efforts by the Commission to "cleanse" the files of serious identity errors would suggest that the data before and after this change are reasonably consistent. Changes in assessment rules over time, with the exception of the change in the Fee Schedule in 1968, have been minimal. The effect of changes that did occur over time is difficult to evaluate. On the whole, these changes probably had a marginal impact on the composition of the flow of claims. The impact of the introduction of

²³ Interview with Ian Rogers, Executive Director of the Medical Care Insurance Commission.

the physician profile system is probably more important but equally difficult to assess. In addition, there is the possibility that the application of the system was not uniform over time. While the former effect may be taken account of in the analysis to be done, the latter cannot. On the whole, however, it seems reasonable to conclude that the data are exceptional in detail and fairly consistent over time.

The Saskatchewan Treasury Department

In 1962 the federal and provincial governments entered into an agreement whereby the federal government collects for the provincial governments their share of the personal income tax. Income tax files are compiled for each province by the federal Department of National Revenue. Copies of those files, compiled on magnetic tapes, are provided to each province.

Records in the tax file contain essentially the same information, with a little less detail, as provided on the "T-1 form" filed by individuals.²⁴ Included in the record are name, address, age, and income information such as total income, taxable income, personal exemptions, etc.²⁵ Records are identified by surname rather than a number and are stored sequentially by the first five characters of the surname.

The validity of the income data in the tax files is, of course, conditioned by the methods of collection. Income tax returns are self-completed. They are, therefore, subject to both unintentional

²⁴ See Department of National Revenue, Taxation Statistics (Ottawa: Queen's Printer, 1970), p. 162ff. for a copy of the form.

²⁵ See Appendix B for a complete description of the record.

and intentional error. The Department of National Revenue, however, employs various techniques to detect both kinds of error.²⁶ Because of the number of returns these efforts are applied on a sampling basis. The validity of the income data is also affected by the definition of income that is used. Income from capital gains is generally not reported because of the absence of a capital gains tax in Canada. Further, many forms of income-in-kind are not reported. This is of particular significance in the case of farmers. The many deductions allowed, along with the possibility of pro-rating income over time, also imply that a farmer's reported income may deviate from his actual income. While this has important implications for the comparability of the level of farm and non-farm income in a particular year, it is less significant when comparing income over time. That is, the factors referred to above are probably constant over time.²⁷ In addition, when the income tax data are compared with that obtainable by alternative methods, namely questionnaires, their shortcomings, while apparent, are less objectionable.

The Saskatchewan Population

Until very recently, the economy of Saskatchewan was essentially agrarian. The changes in population that have taken place reflect this characteristic. From 1901 until the mid 1930's there was a rapid growth in population rising from 492,432 in 1911, to 932,000 in 1936

²⁶ See H. H. Milburn, "Methods of Enforcing the Personal Income Tax," in Canadian Tax Foundation, Report, 1958 Conference (Toronto, 1959), p. 273.

²⁷ See J. Porter, The Vertical Mosaic (Toronto: University of Toronto Press, 1965), Chapter IV for a discussion of the validity and reliability of income tax data.

(see Table 2.1). The depressed state of the "wheat economy" and the attraction of other employment opportunities led to a decline in population which, in 1951, was only 831,728. Even after 1951, the rate of growth of population was low, and it was not until 1963 that the population recovered its 1936 level. Population growth has continued, but at a very low rate, and, in 1969, there was a small loss in population (from 960,000 in 1968 to 956,000 in 1969). Although alternative job opportunities have been made available by development in the mining, manufacturing, and service industries, they have not fully compensated for the decline in labour required by the agricultural sector which has experienced labour saving technological changes in grain farming.²⁸

In addition to these changes in the total population of the province, there have been pronounced changes in the distribution of the population within the province. Saskatchewan, like the other prairie provinces, has a large proportion of its population concentrated in a few urban areas (see Table 2.2). Indeed, two cities, Regina and Saskatoon, account for 25 per cent of the total population. Further, this concentration of population is the result of a rural to urban population shift which began in the 1930's and has continued to the present. Variations in the demand for agricultural commodities along with the labour-saving changes in technology mentioned above, have combined to release population from the rural areas. Expanding employment opportunities in manufacturing, and particularly in the

²⁸ See J. C. Stabler, "Regional Development Theory and the Growth of the Canadian Prairie Region, 1870-1961" (unpublished Ph.D. dissertation, University of Utah, 1969).

TABLE 2.1
 SIZE OF POPULATION, SASKATCHEWAN AND CANADA
 1911-1969

Year	Number	Saskatchewan	Number	Canada
		% Increase Over Preceding Estimate		% Increase Over Preceding Estimate
1911	492,432	439.5	7,206,643	34.2
1921	757,510	53.8	8,787,949	21.9
1931	921,785	21.7	10,376,786	18.1
1941	895,992	- 2.8	11,506,655	10.9
1951	831,728	- 7.2	14,009,429	21.8
1956	880,665	5.9	16,080,791	14.8
1961	925,181	5.1	18,238,247	13.4
1966	955,344	3.3	20,014,880	9.7
1967	958,000	.3	20,405,000	1.9
1968	960,000	.2	20,744,000	1.7
1969	959,000	- .1	21,061,000	1.5

Source: For 1911-1966, Canada, Dominion Bureau of Statistics, 1966 Census of Canada, Vol. 1 (1-1) August, 1969, p. 1-1, Table 1; for 1967, 1968, and 1969 see Canada, Dominion Bureau of Statistics, Canadian Statistical Review, XLIV (July to December, 1969), 18.

TABLE 2.2

PERCENTAGE DISTRIBUTION OF POPULATION BY URBAN
 SIZE GROUPS, RURAL NON-FARM AND FARM, CANADA
 AND SASKATCHEWAN, 1961, 1966

	1961 % of total		1966 % of total	
	Saskatchewan	Canada	Saskatchewan	Canada
<u>Urban</u>				
Over 100,000	12.1	43.4	25.8	47.3
30,000-99,000	13.9	9.3	3.4	8.9
10,000-29,999	5.2	5.7	7.2	5.8
5,000- 9,999	3.8	3.3	2.8	3.5
2,500- 4,999	2.4	3.6	4.1	4.1
1,000- 2,499	5.7	4.3	5.4	4.0
Total	43.0	69.6	49.0	73.6
<u>Rural</u>				
Farm	32.9	11.3	29.2	9.6
Non-Farm	24.0	19.0	21.7	16.9
Total	57.0	30.3	50.9	26.4
Total Number	925,181	18,238,247	955,344	20,104,880

Source: Canada, Dominion Bureau of Statistics, 1966 Census of Canada, Population Rural and Urban Distribution, I (1-8), March 1968.

Canada, Dominion Bureau of Statistics, 1961 Census of Canada, Table 14.

service sector, have attracted many of these people to the urban centres, thus stemming what would have otherwise been very large emigration from the province.

That these population movements are generated by the vagaries of economic conditions is further illustrated by the changes that have taken place in the age and sex composition of the population. New entrants into the labour force have tended to be the most mobile. The loss of young and middle aged males through out-mobility is reflected in the relatively smaller proportion of the population in those age groups (see Table 2.3). The converse of this is that the province has a relatively high dependency ratio; that is, young people of ages less than fourteen years and older people of ages greater than sixty-five years.

The reduced rate of growth of the Saskatchewan population along with the drain of population from rural areas has important implication for the provision of health services. The historical concentration of the population in rural areas accounts for the greater relative availability of hospital beds in Saskatchewan. In addition, the geographic dispersion of the population has resulted in historically high physician-population ratios. The changes that are occurring in the rate of growth of the population and in its geographic distribution, however, have led to a re-evaluation of the hospital construction program. On the recommendation of the Hospital Survey Committee, the Saskatchewan government has adopted a policy of consolidation of small hospitals in rural areas and increased emphasis on hospital construction in the large

TABLE 2.3

PERCENTAGE DISTRIBUTION - POPULATION BY FIVE-YEAR AGE
GROUPS AND SEX, SASKATCHEWAN AND CANADA, 1966

Age Group	Saskatchewan			Canada		
	% of total population Total	Male	Female	% of total population Total	Male	Female
0 - 4	11.3	3.8	5.8	11.0	5.6	5.3
5 - 9	11.5	5.9	5.7	11.5	5.9	5.6
10 - 14	10.8	5.6	5.3	10.5	5.4	5.1
15 - 19	9.3	4.7	4.6	9.2	4.6	4.5
20 - 24	6.5	3.3	3.2	7.3	3.6	3.7
25 - 29	5.5	2.8	2.7	6.2	3.1	3.1
30 - 34	5.5	2.8	2.7	6.2	3.2	3.1
35 - 39	5.8	3.0	2.8	6.4	3.2	3.2
40 - 44	5.8	2.9	2.9	6.3	3.1	3.2
45 - 49	5.6	2.8	2.8	5.4	2.7	2.7
50 - 54	5.2	2.7	2.5	4.9	2.5	2.4
55 - 59	4.4	2.3	2.1	4.1	2.1	2.0
60 - 64	3.6	1.9	1.7	3.3	1.6	1.7
65 - 69	2.9	1.5	1.4	2.7	1.3	1.4
70 - 74	2.5	1.3	1.2	2.1	1.0	1.1
75 - 79	2.0	1.1	.9	1.5	.7	.8
80 - 84	1.2	.7	.6	.9	.4	.5
85 - 89	.5	.3	.3	.4	.2	.2
90 - 94	.1	.1	.1	.1	.04	.06
95 +	.0	.0	.0	.02	.00	.01
Total Number	955,344	489,040	466,304	20,014,880	10,054,344	9,960,536

Source: Canada, Dominion Bureau of Statistics, 1966 Census of Canada, I (1-10), March 1968, Table 19.

urban centres.²⁹ This policy undoubtedly has effects on the number and location of practising physicians. The shift in availability of hospital facilities from rural to urban centres, along with the larger concentrations of population in urban centres explains, in part, the decline in general practitioners in rural areas and the increase in the number of specialists and group practices that have recently occurred.

These changes in population growth and distribution and in availability of health care facilities provide a background against which family utilization of physicians' services may be examined.

²⁹Saskatchewan, Department of Health, Report of the Hospital Survey Committee (Regina: Queen's Printer, 1963).

CHAPTER III

SAMPLING PROCEDURE AND METHODOLOGY

The major objective of this study, as discussed in Chapter One, is to provide estimates of the effects of income and utilization fees on family expenditures for physicians' services. It was argued that, prior to the Saskatchewan experience, little data existed upon which to base such estimates, and further, that such estimates are vital to an assessment of utilization fees as a public policy under medical care insurance. In Chapter Two the agencies in Saskatchewan providing the data for this study were discussed. The nature of the data and its consistency during the period were also examined.

The objectives of this chapter are: (a) to present the reasons for choosing the family as the behavioural unit in the study; (b) to explain the sampling method used in the study and the unique nature of the sample; (c) to examine the representativeness of the sample selected.

The Family

The family has been selected as the unit of analysis primarily because of the nature of medical services and the locus of decisions to seek them. Many individuals are young and dependent, so that the decisions to procure medical services, and payment for them, will be made by the adult members of the family. Indeed, even the adults'

decisions are often made in consultation, and are financed from the income or resources of the family. In a discussion of the appropriateness of the family as the unit of analysis R. M. Andersen, a medical sociologist, observed:

The decision to seek a physician is often jointly made. It may come about only after discussion within the family of bumps, swellings, or "feeling bad." Thus, defining a condition as illness, as something necessitating treatment, in large part depends on the patient's family. These family diagnoses are, of course, particularly important for children. But they often play an important role in lay diagnosis of adults as well.¹

For these reasons most studies of utilization of physician's services have focused on the family.²

The Saskatchewan data available would permit an examination of individuals' expenditures on medical care. The individual's family characteristics could be used as explanatory variables. In addition to the reasons noted above for selecting the family as the unit for analysis, the method of charging for medical services, either under government medicare or private insurance schemes, is usually based upon the family.

The definition of the family of the Saskatchewan hospital and medical care plans has, of necessity, been adopted. The definition departs from the conventional sense of the term "family" in two ways. First, eighteen-year-olds are defined to be separate families even if they are in every respect still dependents of their parents. This

¹R. M. Andersen, "Families' Use of Health Services; a Behavioral Model of Predisposing, Enabling and Need Components" (doctoral dissertation, Purdue University, microfilm, 1968), p. 12.

²See Marguerite Burk, Consumption Economics: A Multidisciplinary Approach (New York: Wiley, 1968), Chapter 9 for a general discussion of the factors influencing choice.

means that one family in the ordinary sense of the term, may be treated as two or more decision-making units. The extent to which the decisions of young adults regarding medical care are family decisions is difficult to assess. It may be noted, however, that under medical care insurance the young adult need not rely entirely on family income to support the decision. The second feature of the definition used is that a family exists, ceases to exist, and undergoes change according to the rules that govern the assignment of registration numbers.³ These rules have been discussed in Chapter Two.⁴

Briefly restated, families may undergo change because of birth (or adoption), death, marriage, or aging. Families may be created or cease to "exist" through entry or exodus from the province, through death of the surviving member(s), and through aging of the children. All of these factors are considered in the procedures for assigning registration numbers. Family changes may, but need not necessarily, imply registration number changes. In situations where there is simply a change in the number of dependents in a given family, no changes in registration number will occur. Alternatively, where the individual is the surviving, or only, member of the family, both the beneficiary number (identifying the person as a member of a family) and the registration number (identifying the family itself) will change to a status of inactive indicating that the family no longer exists. Therefore, since the registration number identifies the family, the

³An exception to this is the Saskatchewan Assistance Plan beneficiaries. In April 1966 such beneficiaries were assigned a new number. The data were corrected for this administrative number change. The effect remains, however, that such a "family" has a higher probability of being selected in the sample.

⁴See Chapter Two, p. 22.

words "family" and "registration number" may be used interchangeably for purposes of discussion. A family, of course, as discussed before, can be a single individual but a single individual need not necessarily be a family. An individual will be referred to exclusively by the beneficiary number; a family by the registration number.⁵

The Sample

From the discussion of the available data it is apparent that an analysis of the effects of income and utilization fees on family utilization of physicians' services could be based upon data for the entire population. While this is technically possible, it is, of course, not practical. The volume of data to be examined, even though it is in machine readable form, makes the cost prohibitive. Therefore, this study is based on a random sample of the population and provides estimates of the relevant population parameters.

Two considerations influenced the selection of the sample: (a) the desirability of getting observations over time; and (b) the constraints imposed by the procedures of the data collection agencies. As a result the sampling was done in two stages. An "overall" sample was drawn first and then sorted into a set of cross section samples for each year. The nature of these samples and the way that they were drawn is discussed below.

Since families in the population are represented by registration numbers, a random sample was drawn from the cumulative list of all

⁵The number assigned to an individual, it will be recalled, is an eight digit number. The first six digits identify the family and are called, in this discussion and hereafter, the registration number; the last two digits identify members of a given family and are called beneficiary numbers.

assigned registration numbers. This cumulative list contains all registration numbers that had been assigned since the inception of the medical care plan.⁶ From the cumulative list, which contained at the time of sampling 540,000 registration numbers, a random sample of 54,000 registration numbers was selected.⁷

Of the 540,000 registration numbers in the cumulative list, at the time of sampling 370,000 were active. Of the 54,000 numbers in the overall sample, 39,415 were active. The terms "active" and "inactive," it will be recalled, refer to eligibility of the family for services.⁸ That is, if a family is eligible for services under the Medical Care Insurance Act, and if its premium has been paid, it is an active family. The term does not refer to whether or not the family has actually used physicians' services. An inactive status results from death, exodus from the province, or the reassignment of identification numbers, or, of course, lapse of premium. In the second last case, for example, a single eighteen-year-old girl is an active family. But when she married she joins another family and her maiden family number becomes "inactive."

The fact that 39,415 families were active in 1969 does not mean

⁶ Actually numbers were originally assigned when the hospital services plan began in 1947. Thus the list contains numbers assigned and adopted by the medical care plan and assigned since then.

⁷ The sample was selected by the Saskatchewan Government IBM 360/50 computer using a count and random skip procedure. Sample was drawn June 26, 1969.

⁸ Strictly speaking, the discussion here should be in terms of individuals or beneficiaries, for it is only through the individual that the family may undergo change. The status of a record is the status of the beneficiary record first; if the individual constitutes the family then the status refers to the family. Since the family is of prime interest, the discussion is presented in family terms.

that these families were eligible for services from the beginning of the study period. Some of these families may have come into existence between 1963 and 1969. For example, a family entering the province in 1966 whose registration number had been selected in the sample would not be eligible for services in years prior to entry. Thus the terms "active" and "inactive" only designate the status of families when the situation is viewed for a certain period of time. The term "nonexistent" will be used to refer to the time during which a registration number (which is active or inactive at the time of sampling) had been unassigned. The family referred to in the above example would have been "nonexistent" prior to 1966.

Since the random sample of 54,000 families contains families that are active, inactive, or nonexistent depending upon the units of time being considered, this overall sample may be sorted into yearly sub-samples of families active in the respective years. This involves dropping the inactive and nonexistent families for each of the time periods considered. The 1969 sub-sample is made up of the 39,415 families that were active at that time. The 1968 sub-sample is simply the overall sample minus the families that were inactive or "non-existent" in 1968.

A comparison of the 1969 sub-sample and the 1968 sub-sample illustrates the procedure. Some of the families who were in the 1969 sample cannot be in the 1968 sample because they had not received a registration number until 1969; that is, they had not yet entered the province or had not reached the age of eighteen. These families are the 1968 nonexistents that are in the 1969 sample. Some of the families that were excluded from the 1969 sample as inactives must be

included in the 1968 sample--namely those families who left the province, or whose surviving member had died in 1969. Thus the 1968 sample and the 1969 sample do not contain a common set of families (or individuals), but reflect the same kind of turnover as occurs in population.

By a similar procedure, samples of active families for the other years back to 1963 may be collected. Figure 3.1 illustrates the relationship of the samples to each other.

Each of the sub-samples compiled represents a cross section random sample of families for their respective years. The above procedure is equivalent to repeated sampling at the end of each year. That is, if a random sample were drawn, say in 1966, the families that were inactive at that time would be bypassed for that reason; the families that were "nonexistent" at that time would not be in the population list. Since the 1966 "inactives" and "nonexistents" were dropped from the overall sample to get the 1966 sub-sample, the two approaches are consistent.⁹

The time series analysis in this study will be based upon the set of sub-samples. It is obvious that over time the membership of the samples is not constant. It is technically possible, although not practical, to select a sample of families who were covered throughout the entire period.¹⁰ Moreover, such a sample would exclude a number

⁹While each of the sub-samples represents a random cross section sample, the set of sub-samples are not strictly equivalent to repeated independent random samples. A selected family that is active for the entire period will appear in all of the sub-samples.

¹⁰As many as forty coverage entries may have to be examined for each member of a family to determine if that family would be eligible for selection.

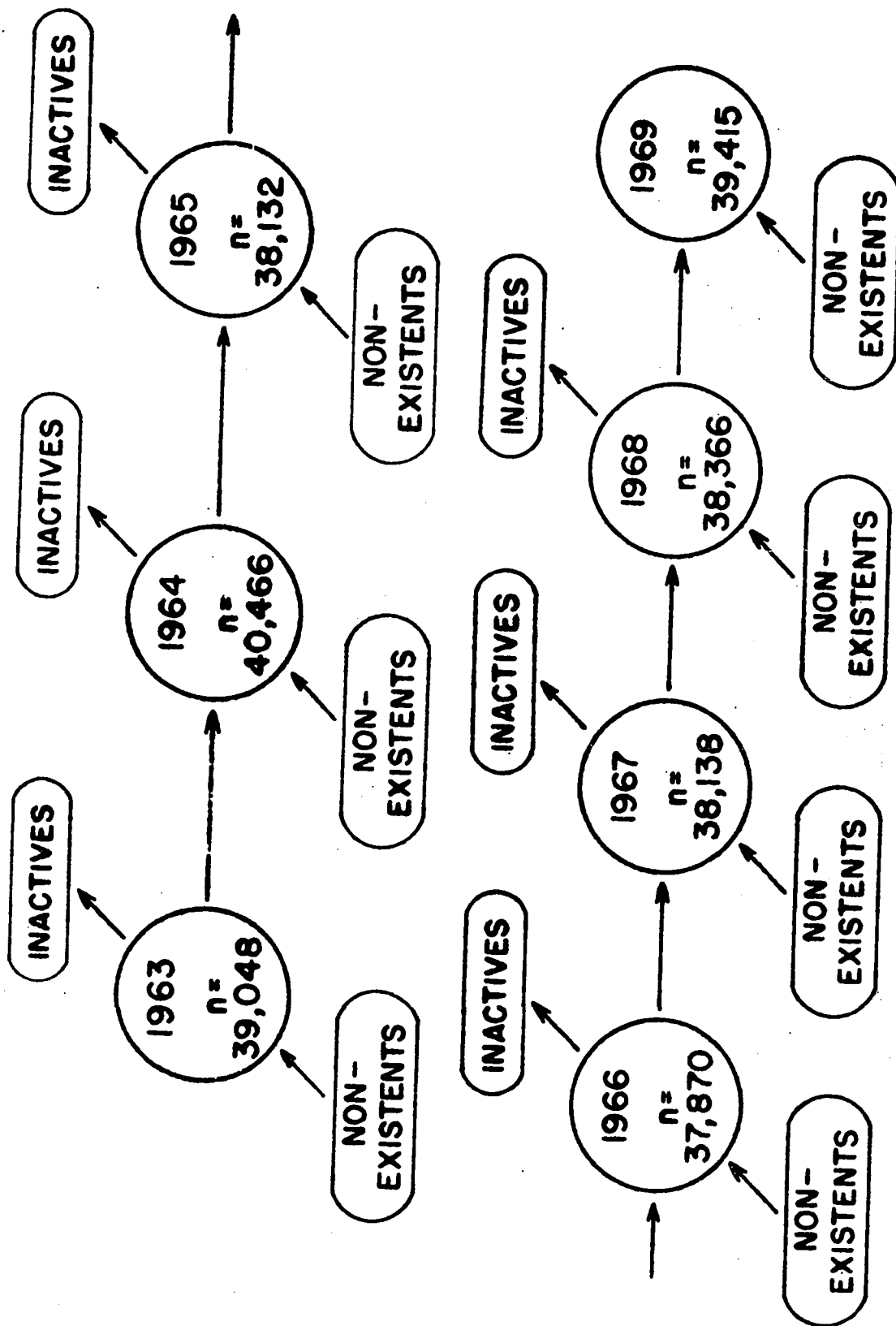


FIGURE 3.1. SCHEMA OF SAMPLES

of families that are of particular interest. Among those excluded would be families affected by a youth reaching the age of eighteen (both the old family and the new family), families with a member dying in the study period, and families entering or leaving the province in that period. These phenomena, with the exception of the latter, are manifestations of the aging process. The families that were included in such a sample, however, would be subject to aging. It is also possible to select a set of families with dependents who are covered over the whole period. In this case, families with children born in the study period would have to be excluded along with those mentioned above. It is only families who are at the two extremes of the aging process--those experiencing birth and death, and families with children who will reach eighteen years of age in the period--that would be excluded in such a sample. The former two groups of families are generally associated with high medical expense. Therefore, such a sample would exclude from consideration important groups of families. If the objective of the analysis is to identify the factors influencing utilization of physicians' services, then all of the factors influencing population behavior must be included in the sample. Finally, the requirement that the data be related to a constant group of families (as in the first case above), or individuals (as in the second case), is seldom satisfied in studies of consumption, demand or supply. For example, estimation of the demand function for automobiles over a period of time would not necessarily be based on the consumption expenditures of the same families over the period. The implicit assumption is, of course, that the groups or individuals entering and leaving the data set have similar preference functions. In the samples

described above the assumption is that the families entering a given sub-sample, say year 1963, have similar preference functions to those entering any other sub-sample. The same assumption is made for the families leaving each sub-sample.

The Representativeness of the Samples

It has been argued above that the sampling procedures yield the equivalent of repeated cross section random samples. Each of these samples may be examined for representativeness by comparing sample proportions and population proportions for various characteristics.

The records in the Master Registration File, from which the samples were drawn, contain information on age, sex, marital status, location, family size, etc. The structure of each annual sample may be compared with corresponding population structure for any of these variables. This is done for family size and location. Table 3.1 presents the distribution by size of family for each of the annual samples and for the population in the corresponding years. Inspection of the table suggests that the samples are representative of the populations in each of the years. A chi square test on the null hypothesis that the samples come from their respective parent populations yields calculated values of chi square less than 1.0 for all years.¹¹ Since the critical value of chi square is 11.07 for the appropriate degrees of freedom, the null hypothesis cannot be rejected. When compared with the population on the basis of family size then the samples are representative.

¹¹The calculated values of X^2 for the years 1963-1968 are respectively 0.34, 0.08, 0.16, 0.46, 0.15, 0.18.

TABLE 3.1

DISTRIBUTION OF ACTIVE FAMILIES BY SIZE OF FAMILY
FOR EACH OF THE SAMPLES AND FOR THE POPULATIONS

Family Size	1963		1964		1965		1966		1967		1968		1969	
	Sample %	Pop.* %	Sample %	Pop.* %	Sample %	Pop. %	Sample %	Pop. %	Sample %	Pop. %	Sample %	Pop. %	Sample %	Pop.** %
1	38.53	40.59	40.68	40.57	40.07	41.22	40.25	42.80	42.40	43.72	42.33	43.86	43.97	42.81
2	20.25	19.66	19.50	19.66	19.72	19.74	20.14	20.01	21.61	20.14	21.85	20.33	20.82	21.42
3	10.59	10.74	10.27	10.60	10.21	10.40	10.00	10.07	9.86	9.87	10.06	10.03	9.79	10.01
4	11.82	11.62	11.38	11.47	11.50	11.10	11.30	10.57	10.32	10.30	10.38	10.30	10.38	10.20
5	8.20	8.11	7.92	8.20	7.96	8.03	7.86	7.54	7.15	7.31	6.94	7.14	6.75	6.92
6+	10.62	9.24	10.25	9.49	10.54	9.51	10.44	8.98	8.66	8.62	8.44	8.31	8.28	8.64
Total No.***	39,048	309,143	40,466	306,344	38,132	317,286	37,870	337,930	38,138	347,180	38,366	351,793	39,415	364,727

Source: Population figures from: Medical Care Insurance Commission, Annual Report, 1966, 1968 (Regina: Queen's Printer)

* Estimated data supplied by Saskatchewan Hospital Services Plan.

** Derived from Medical Care Insurance Commission, Annual Report, 1969 (Regina: Queen's Printer), Table 8.

***This table was prepared before an adjustment was made for registration number changes of Saskatchewan Assistance Plan beneficiaries (see Table B.5 in Appendix B). The correct totals for the sample for the years 1963 through 1969 respectively are: 38,973, 40,391, 38,057, 37,854, 38,138, 38,348. Since the difference between these totals and the totals in the table were so small the table was not corrected. 5

In addition to the data available from the Master Registration File, medical expenditure and income data were collected for the families in the samples. Distributions for these data may also be examined for "goodness of fit."

The medical care expenditures for the sample families were drawn from the Patient History File of the Medical Care Insurance Commission. As mentioned in Chapter Two, the same identification system is used for both sets of data. Linking the data was, therefore, not difficult.

Distributions of medical expense by type of service are presented in Table 3.2 for the sample and the population. This table was prepared by grouping claims for services according to the fee schedule code under which they were paid. The list of fee schedule codes for each group was provided by the Medical Care Insurance Commission and is the same list that was used in compiling the 1969 Annual Report.

Some difficulties occur when this list is used for groupings in the earlier years. The 1969 groupings were slightly different than the groupings used to compile the population statistics in the years prior to 1969. For the years 1966 to 1968 inclusive the population groups differ from the sample grouping for three categories: other diagnostic procedures, major therapeutic procedures, and obstetrics. The population figures for these three groups were adjusted to make them compatible with the sample.¹² In the years 1963 to 1965 inclusive there are differences in the number and names of the groups used

¹² Adjustments were supplied by the Commission's Research Branch.

TABLE 3.2
DISTRIBUTION OF PAYMENTS BY TYPE OF SERVICE

	1963		1964		1965	
	Sample %	Population %	Sample %	Population %	Sample %	Population %
Complete examinations	28.25 ^a	29.35	27.71 ^a	27.88 ^a	28.42 ^a	28.21
Regional and minor examinations	6.40	6.51	6.23	6.16	6.10	6.15
Home and emergency visits	11.43	12.24	11.23	10.90	10.67	10.58
Hospital visits	3.33	3.51	3.50	3.45	3.57	3.67
Consultations	.71	.62	.96	.89	1.08	.97
Psychiatric services	4.09	4.39	2.86	2.75	3.09	3.04
Laboratory services	3.83 ^b	--	4.27	4.28	4.46	4.49
Diagnostic radiology	23.03	27.25	18.76	18.89	19.28	18.83
Other diagnostic procedures	8.36	8.55	7.01	7.15	6.11	6.29
Major surgery	5.06	5.44	4.72	4.85	4.93	5.03
Minor surgery	1.38 ^b	--	1.29	1.25	1.39	1.32
Obstetrics	.22	.22	.39	.35	.42	.44
Anaesthesia	.11	.34	.13	--	.12	--
Surgical assistance	.37	--	.42	.30	.32	.28
Allergy services	1.85 ^c	--	1.93	2.04	2.04	2.10
Therapeutic radiology	1.55	1.58 ^d	1.63	2.11	.96	1.49
Major therapeutic procedures	.01	--	.00	--	.00	--
Minor therapeutic procedures	.00	--	.00	--	.00	--
Miscellaneous						
Refractions by physicians						
Services by optometrists						
Total payments	\$2,131,453.60	18,270,400.	2,483,488.98	20,354,900.	2,719,281.95	20,151,300.

^aThe sum of complete examinations and regional and minor examinations in the sample is compared here with the sum of initial and repeat office visits in the population.

^bThese groups should be included with surgery for comparability with the population.

^cOne half of this group should be included with surgery and the other half with examinations.

^dThis includes a section called Special and Office Procedures in 1963, but dropped thereafter.

TABLE 3.2 (concluded)

	1966		1967		1968	
	Sample %	Population %	Sample %	Population %	Sample %	Population %
Complete examinations	7.23	7.33	7.56	7.55	9.51	8.78
Regional and minor examinations	21.32	21.41	20.72	20.90	16.41	15.19
Home and emergency visits	6.72	6.74	6.38	6.46	6.57	6.23
Hospital visits	11.13	11.06	10.61	10.66	11.14	11.80
Consultations	3.86	3.97	4.28	4.42	4.84	5.04
Psychiatric services	1.42	1.31	1.79	1.63	1.98	2.21
Laboratory services	3.37	3.33	3.93	3.85	4.14	4.27
Diagnostic radiology	4.50	4.51	4.88	4.89	4.29	4.60
Other diagnostic procedures	4.37	4.54 ^e	4.74	4.76 ^e	4.31	4.71 ^e
Major surgery	19.34	18.52	18.61	18.33	17.55	18.40
Minor surgery	2.88	2.90	2.85	2.84	2.70	2.62
Obstetrics	4.84	5.16 ^e	4.44	4.52 ^e	4.96	5.17 ^e
Anaesthesia	4.84	4.80	4.79	4.79	4.81	4.89
Surgical assistance	1.34	1.34	1.35	1.33	1.37	1.38
Allergy services	.47	.50	.53	.54	.48	.54
Therapeutic radiology	.08	--	.11	--	.10	--
Major therapeutic procedures	.26	.50 ^e	.46	.51 ^e	.66	.59 ^e
Minor therapeutic procedures	2.03	2.06	1.96	2.02	1.62	1.69
Miscellaneous	.00	--	.00	--	.21	--
Refractions by physicians	.00	--	.00	--	1.19	.87
Services by optometrists	.00	--	.00	--	1.34	1.03
Total payments	\$2,704,750.50	22,196,900.	2,841,944.01	23,377,100.	3,043,241.61	24,072,600

^e Adjusted for differences in groupings. The fee grouping for 1969 was used.

for the population. The adjustments for group compatibility in 1964 and 1965 are noted in the table. Finally, in 1963 the following groups do not occur at all in the population figures: other diagnostic procedures, surgical assistance, and major and minor therapeutic procedures. The two categories other diagnostic procedures and surgical assistance should probably be included with the surgery category. The two therapeutic procedures categories should probably be distributed among the examinations, laboratory services, and surgery categories.¹³

When the adjustments are made for grouping differences the distributions of payments by type of service for the samples compares favourably with the corresponding population distributions. A chi square test on each of the samples and their corresponding population indicates that the differences between the samples and their populations are not statistically significant.¹⁴

The last source of data is the Income Tax Returns for the province. Since the income tax records are not identified by registration-beneficiary numbers, collection of these records was difficult. The records were collected by searching the annual tax files for the members of the samples.¹⁵ The search was based on name, age, and address. A discussion of the procedure and its reliability

¹³It is difficult to confirm this because the Research Branch, which is responsible for compiling this data, was not established by the Medical Care Commission until 1964.

¹⁴The calculated values of χ^2 for the years 1963-1968 are respectively 0.42, 0.21, 0.25, 0.20, 0.04, 0.58. The critical values for the appropriate degrees of freedom and the 5 per cent level of significance are respectively 5.23 (1963), 8.67 (1964-1967), 10.12 (1968).

¹⁵Search was not conducted for individuals less than sixteen years of age in a given tax year.

is contained in Appendix B.

Since the address information in the Master Registration File was the most recent address, this criterion for identification deteriorates as the search progresses back to the earlier years in the tax file. Thus the distributions of income for each of the samples may be expected to get progressively worse as earlier years are examined. This, of course, would require that mobility be specific to certain income classes. If mobility is not specific, then the effect of address changes should be reflected in smaller numbers of individuals found. The sample as a proportion of the population would become smaller for earlier years.

A second factor that must be considered in comparing the sample and population distributions is that the sample is random for families, not for individuals. The selected tax records will, therefore, be random only to the extent that families do not contain more than one income receiver. Families with more than one income receiver will be over-represented in the sample.¹⁶

The distribution of income for each of the samples and for their respective populations are presented in Table 3.3. It should be noted that the distributions presented are distributions of taxable returns not family income. That is, they are distributions by income class of the taxable returns for individual members of the families in the random samples. If a family member did not file an income tax return he would not appear in the table. Thus there is a difference between

¹⁶The number of families with more than one income receiver in 1967, for example, is 7,870 out of 39,708 families for whom income records were found.

TABLE 3.3
DISTRIBUTION OF TOTAL INCOME BY INCOME GROUP

Income Class	1963		1964		1965		1966		1967		1968	
	Sample %	Pop. %	Sample %	Pop. %	Sample %	Pop. %	Sample %	Pop. %	Sample %	Pop. %	Sample %	Pop. %
\$ 0- 1,000	.47	.46	.41	.26	.08	.38	.12	.57	.19	.44	.19	.34
1,000- 1,500	6.11	5.74	6.18	5.66	5.88	5.32	5.84	5.10	4.95	4.78	5.06	4.93
1,500- 2,000	8.10	8.14	7.88	7.40	8.10	7.23	8.47	7.11	7.17	6.65	7.29	6.89
2,000- 2,500	9.85	9.33	9.54	9.04	9.17	8.48	8.85	8.31	7.64	7.70	8.09	7.50
2,500- 3,000	10.25	10.12	10.03	9.55	9.76	9.33	9.28	8.75	8.37	8.69	8.03	7.72
3,000- 3,500	10.41	10.81	9.84	9.40	9.34	9.46	9.65	9.45	8.94	8.53	8.62	8.79
3,500- 4,000	9.96	9.65	9.44	10.08	8.64	8.92	8.16	8.39	7.90	8.05	7.94	7.75
4,000- 4,500	9.09	9.32	8.78	9.14	8.41	8.55	7.62	8.21	7.50	7.44	7.16	7.06
4,500- 5,000	8.25	8.20	7.56	7.66	7.47	7.70	7.33	7.31	7.25	6.86	7.01	6.36
5,000- 5,500	6.10	6.08	6.51	6.72	6.62	7.24	6.13	6.61	6.36	6.21	6.12	6.38
5,500- 6,000	4.60	4.30	4.95	4.88	5.15	5.66	5.45	5.50	5.89	5.69	5.26	5.59
6,000- 7,000	5.98	6.39	6.82	6.89	7.36	7.57	7.70	8.23	9.32	9.39	9.19	9.82
7,000- 8,000	3.61	4.06	3.99	4.06	4.53	4.48	5.03	5.23	5.49	5.83	6.35	6.27
8,000- 9,000	2.02	2.23	2.71	2.90	2.74	2.68	3.14	3.39	4.00	4.02	4.11	4.43
9,000-10,000	1.40	1.44	1.45	1.75	1.92	1.92	2.14	2.23	2.61	2.70	2.70	2.77
10,000-15,000	2.53	2.54	2.97	3.20	3.35	3.56	3.45	3.99	4.52	4.97	5.06	5.38
15,000-20,000	.67	.60	.76	.74	.79	.82	.92	.94	1.06	1.19	.91	1.15
20,000-25,000	.21	.24	.26	.30	.32	.31	.31	.33	.38	.40	.47	.41
over 25,000	.34	.32	.35	.37	.37	.29	.41	.38	.45	.45	.45	.46
Total number	20,440	195,004	22,976	215,055	23,400	230,081	25,702	253,011	26,318	268,511	26,762	269,725

Source: Department of National Revenue, "All Returns by Province and Income," Taxation Statistics, 1965, 1966, 1967, 1968, 1969, 1970.

the total number in the samples in Table 3.3 and the total number in the samples in Table 3.1. Table 3.3 refers to individuals and Table 3.1 refers to families. If each family had only one income recipient, then a comparison of the total numbers for the two tables would suggest that income data was found for an average of 60 per cent of the families.¹⁷

A final factor must be considered in comparing the sample and population data in Table 3.3. The population data are not in fact population data but rather are estimates by the Department of National Revenue. These estimates are based upon a random sample of the provincial income tax returns.¹⁸ Thus the comparison that is presented is a comparison of two random samples. The data or samples for each year may be tested for homogeneity using a chi square distribution.¹⁹ The null hypothesis that the two samples came from the same population cannot be rejected at the 1 per cent level of significance.²⁰ Therefore, the sample data can be accepted as representative of the population.

¹⁷The families for whom no income data was found would include those who had no income, such as welfare and pension recipients and students, and those for whom the search failed. See Appendix B, p. for an analysis of the composition of this group.

¹⁸See Taxation Statistics, op. cit., p. 4, for description of compiling.

¹⁹A statistical test for homogeneity cannot be performed since the size of the National Revenue samples is unknown. Therefore, it is assumed that the National Revenue data are population data and a goodness of fit test is performed.

²⁰The calculated values of X^2 for the years 1963-1968 are respectively 0.22, 0.39, 0.64, 1.07, 0.34, 0.40. The critical value for 18 degrees of freedom is 7.01 at the 1 per cent level of significance.

CHAPTER IV

THE ANALYTICAL FRAMEWORK

The objectives of this chapter are: (a) to describe the variables that are constructed for individual families; (b) to present the regression model that will be used to analyze the data; and (c) to discuss the expected relationships between family medical expense and the various explanatory variables. Since the main purpose of the analysis is to determine the magnitude of the effects of utilization fees on family medical expense, these expected relationships are of secondary interest. The nature of such relations has, of course, been the subject of numerous studies. The results in this study are of particular interest because of the unique way that medical care is financed. In addition, the data allows examination of the behaviour of relationships over time.

The Variables

Since the observational unit in this study is the family and since the data collected are recorded on an individual basis, it is necessary to construct a family record. The family record is made up from three sources: the demographic part from the Master Registration File; the medical expenditure part from the Patient History File; and the income part from the Income Tax Returns. The family record was compiled by summing the relevant data for a given variable over all

members of the family. In the case of medical expenditures, for example, the claims experience of all members of a given family are summed to yield the family's medical expenditure for all physicians' services. Expenditure variables were also constructed for several sub-categories of service, in addition to expenditure by type of practitioner (general practitioner or specialist). The unit of time over which the summation is done is one year.

A list of the variables in the family summary record that are used in subsequent analyses is presented in Table 4.1. The first four variables are compiled for all services and for each of eleven sub-categories of service. These sub-categories are: complete examinations; regional examinations; home and emergency visits; hospital visits; consultations; laboratory services including diagnostic radiology; psychiatric services; major surgery including other diagnostic procedures and surgical assistance; minor surgery; obstetrics; and anaesthesia.¹ An income variable was compiled for taxable income and for disposable income in addition to total income shown in the table.² Dummy variables were constructed to describe family characteristics. The construction of the dummy variables for age, marital status, location, number of children, and welfare status is shown in the table.³

¹The groupings of the fee schedule codes are those used by the Medical Care Commission.

²Only total income is used in subsequent analysis since the results of small runs on the three income variables did not differ.

³Means and standard deviations for the variables are provided in the Statistical Appendix.

TABLE 4.1

LIST OF VARIABLES IN FAMILY RECORD

FAPP _i	The sum of the fees approved for all services that fall in the i th category and are provided to the members of a given family.
NGP _i	The number of services in the i th category provided by general practitioners to all members of a given family.
NSP _i	The number of services in the i th category provided by specialists to all members of a given family.
NUMSER _i	The number of services provided to all members of the family.
DCG _i	The cumulative sum of 15% of the fees approved for all services which are billed directly to the patient. This is summed for all such services to all members of a given family.
FAMSZ	The size of the family including the parents.
GPFAPP	The sum of fees approved for all services provided by general practitioners to members of a given family.
SPFAPP	The sum of fees approved for all services provided by specialists to members of a given family.
TOTINC	The sum of total income from the tax record for all members of a given family.
TAXINC	The sum of taxable income from the tax record for all members of a given family.
DISINC	The sum of disposable income for all members of a given family. Disposable income equals total income minus tax paid.

TABLE 4.1 (concluded)

VAR001	Equals 1 if the female spouse is absent and 0 otherwise.
VAR002	Equals 1 if the male spouse is absent and 0 otherwise.
VAR003*	Equals 1 if the family has one child and 0 otherwise.
VAR004	Equals 1 if the family has two children and 0 otherwise.
VAR005	Equals 1 if the family has three children and 0 otherwise.
VAR006	Equals 1 if the family has four children and 0 otherwise.
VAR007	Equals 1 if the family has five or more children and 0 otherwise.
VAR008	Equals 1 if the age of the family head is 25-34 years and 0 otherwise.
VAR009	Equals 1 if the age of the family head is 35-44 years and 0 otherwise.
VAR010	Equals 1 if the age of the family head is 45-54 years and 0 otherwise.
VAR011	Equals 1 if the age of the family head is 55-64 years and 0 otherwise.
VAR012	Equals 1 if the age of the family head is 65-74 years and 0 otherwise.
VAR013	Equals 1 if the age of the family head is 75 years or more and 0 otherwise.
VAR014	Equals 1 if the family lives in an urban centre with a population of 10,000 or more, and is 0 otherwise.

*As the dummy variable matrix is set up here the estimated coefficients are not marginal concepts. In the work that follows the first differences of the coefficients pertaining to number of children are presented.

The Model

While the main purpose of this study is to determine the effects of utilization fees on family expenditure patterns for medical care, the method of doing this is somewhat indirect. First, parameters must be estimated for the variables that explain variations in family medical expenditures. These parameters are then used in Chapter Six to predict family medical expense in the absence of utilization fees.

In order to examine the influence of each of the explanatory variables on family medical expenditure behaviour a regression model is used. The underlying assumption in the analysis is that family expenditure for physicians' services depends upon a number of variables, both economic and demographic. The demographic variables are indices of tastes or preferences. The economic variables, price and income, are the ordinary market constraints against which the family compares benefits from consumption.

Implied in the above assumption is the additional assumption that the decision to seek medical services is a family decision. A number of writers, in discussing models of consumption of medical services, have noted that the decision to procure such services may involve the providers of the service.⁴ The argument is particularly persuasive in the case of certain types of service. Repeat visits and services such as surgery and hospitalization take place largely on the advice of the physician. The type and amount of services provided

⁴For a good discussion of demand models for health care see, Grover Wirick and Robin Barlow, "The Economic and Social Determinants of the Demand for Health Services," in The Economics of Health and Medical Care, Proceedings of the Conference on the Economics of Health and Medical Care (Ann Arbor: University of Michigan, 1964).

may, in a number of cases, be dictated by the so-called "technological imperatives" which ultimately only the physician is properly able to evaluate.⁵ Nevertheless there remains considerable scope for family choice in seeking physicians' services. The initial decision when and whether to see a physician is entirely a family decision. Further, the decision to follow a physician's advice is one that the family must make. Thus, variables associated with the family may explain some of the variation in family utilization of physicians' services.⁶

The influence of these variables is estimated by fitting a single regression equation to each of the sets of annual observations on medical expenditure and family characteristics. The method is ordinary least squares. The regression equation has the following form

$$FAPP_1 = a_1 + a_2 DGG_1 + a_3 TOTINC + a_4 VAR001 + \dots + a_{19} VAR014 + u_1$$

where the variables are as defined in Table 4.1 and u_1 is an error term assumed to be normally distributed with a mean of zero and a variance of σ^2 .

There are several restrictions imposed by this model. It is a highly aggregative model which assumes that there are no interaction

⁵The term is taken from Kong-Kyun Ro, "Patient Characteristics, Hospital Characteristics and Hospital Use," Medical Care, VII, No. 4 (July-August 1969). For a full discussion of the role of need in consumption decision making see Kenneth Boulding, "The Concept of Need for Health Services," Milbank Memorial Fund Quarterly, LXIV (October 1966).

⁶The amount of variation in family medical expense explained by the independent variables, of course, is expected to be small. It is well known in insurance literature that expenditures can only be predicted accurately for groups of families. In addition, this is typically true for cross section data on individual observation.

effects between the independent variables. The effects of age are assumed to be the same for couples and for single males and females. The cost of an extra child is assumed to be the same whether the family is headed by a couple or a single individual and regardless of the age of the family head. Thus the coefficient a_7 is the cost of two children for any age of the family head and for any family type. In addition, the effect of absence of the spouse is assumed to be the same for all age levels and family sizes. Finally, the effect of a change in income or a change in direct charges is assumed equal for all types of families and all age levels.

Interactions effects could be examined by dividing each annual sample into sub-samples by family type and by estimating separate equations for each class. Full estimation of each such class, however, would not be possible owing to the paucity of observations for many classes. Table 4.2 shows the distribution of the sample for 1967 by age, size, and marital status of the family.⁷ Of the 126 cells, 76 have less than fifty observations. An aggregative model, while imposing some restrictions, does preserve degrees of freedom.

Alternatively, interactions effects could be examined by defining the dummy variables differently. A new dummy variable could be defined for each kind of interaction.⁸ The difficulty here is that the number of such variables becomes unmanageable. With three levels of family type, seven age levels, and six levels for number of children

⁷Tables for the other years are presented in the Statistical Appendix.

⁸See N. R. Draper and H. Smith, Applied Regression Analysis (New York: John Wiley & Sons Inc., 1967).

TABLE 4.2
 NUMBER OF FAMILIES WITH COVERAGE DURING 1967, BY
 AGE OF HOUSEHOLD HEAD AND SIZE OF FAMILY

Type of Family	Age of Head					Total
	15-24	25-34	35-44	45-54	55-64	
Couples						
with 0 children	1132	926	336	1019	2191	8,871
1 child	341	867	447	964	730	3,473
2 children	116	1172	1100	940	359	3,741
3 children	14	719	1058	666	144	2,619
4 children	1	374	777	378	70	1,610
5+ children	1	185	856	435	63	1,552
					9	<u>21,866</u>
Single Females						
with 0 children	2418	446	291	542	795	6,986
1 child	77	60	62	88	49	343
2 children	33	51	48	51	12	197
3 children	6	33	38	23	1	101
4 children	4	19	19	12	0	54
5+ children	0	22	33	8	0	63
					0	<u>7,744</u>
Single Males						
with 0 children	2986	945	788	768	715	7,900
1 child	12	16	17	33	54	310
2 children	15	21	13	15	18	88
3 children	4	23	18	25	20	91
4 children	2	15	21	13	3	54
5+ children	1	22	34	15	6	80
					1	<u>8,523</u>
					1	<u>38,133*</u>

*There are 5 observations missing in this table. This may be a result of the inability of the computer program to handle situations where the head of the family was 100 years old or more.

the number of simple interaction dummy variables required would be 126. While the sample size is large enough to allow this, the computational costs become prohibitive. Each additional variable added to the correlation matrix increases the cost of producing that matrix by a multiple. Another problem with defining multiplicative interactions variables is that multicollinearity is introduced into the regression equation. The aggregative model, therefore, has the virtue of being directly applicable and reasonably efficient.⁹

The Analysis

The dependent variable in this analysis is family expenditures on physicians' services. Since the fee schedule is constant for the period 1963 to 1967, expenditure is a reasonable index of quantity consumed.¹⁰ Changes in the quantity of services are reflected in changes in family expenditure. A change in the composition of services is also appropriately reflected since each type of service is weighted by its own price or fee.

In comparing the 1967 and 1968 estimates the use of expenditures as a dependent variable results in underestimation of the coefficients since prices increased in mid-1968 with the introduction of the centennial edition of the fee schedule. Increases in expenditure in 1968 may result, therefore, from an increase in the quantity

⁹Feldstein attempted to get around this problem by using extraneous information on physician use patterns for demographic classes, but this yielded no relationship between demographic changes and demand for physicians' services. See M. S. Feldstein, "The Rising Price of Physicians' Services," Review of Economics and Statistics, LII, No. 2 (May 1970).

¹⁰The exception to this is that the rate of payment was raised from 85% to 95% of the fee schedule on November 1, 1967.

of services taken or from a change in price. As a consequence, equations are also estimated using the number of services as the dependent variable when considering those years.¹¹ A problem here is that the number of services is a simple count of heterogeneous services. That is, a laboratory service and a complete examination are each counted as one service. If the composition of services changes significantly then the number of services is a less satisfactory index. When the number of services is used as the dependent variable the assumption is made that the structure of services remains unchanged or at least that such changes are small.

The independent or explanatory variables used in subsequent analysis are described below.

1. Income--The relationship between income and expenditures on medical care has been examined in a number of studies. In general, studies have shown a positive relationship between income and medical expenditures. That is, medical care appears to be a "normal" good so that higher income means higher medical expense. Usually the income variable used is current income, although recent studies have used transitory and permanent income variables.¹²

In the absence of complete coverage by medical care insurance,

¹¹Not only is expenditure affected by price changes, but also quantity of services may be affected if quantity is a function of the rate of profit per service. The assumption in this analysis, as mentioned above, is that demand is a family decision. No account is taken of the possibility that the providers of service may participate in that decision.

¹²See Ronald Andersen and Lee Benham, "Factors Affecting the Relationship Between Family Income and Medical Care Consumption," in H. E. Klarman (ed.), Empirical Studies in Health Economy (Baltimore: Johns Hopkins Press, 1970).

the hypothesis that consumption is a function of income is fairly commonplace, although the role of economic variables has been questioned.¹³ Under insurance with comprehensive coverage income ceases to be a market constraint. But a positive relationship between income and medical expense may still be found. If there are opportunity costs in getting medical services such as lost time from work, or if there are associated costs such as transportation or drugs, income may continue to be a significant explanatory variable. In addition, income may still play a role as an index of tastes. If prior to the introduction of medical care insurance, income was an important determinant of medical expenditure, utilization habits may have been formed by income groups. With the introduction of insurance the income coefficient may thus still be positive although with a reduced magnitude. Further, with the passage of time the size of the income coefficient may be expected to decline through the erosion of habit or a negative learning effect.

There are some grounds, on the other hand, for expecting a negative relationship between income and medical expenditure. If illness is disabling it may involve loss of income. Therefore, as medical expense increases income may decrease. Presumably this hypothesis would find greater support when components of medical service were examined since some types of service involve greater

¹³For a discussion of the role of economic variables in family decision making and medical services see Ronald Andersen, A Behavioral Model of Families' Use of Health Services (Center for Health Administration Studies, University of Chicago, 1968).

disability than others.¹⁴

2. Prices--The relationship between price and medical care expenditure is expected to be negative. Higher prices are expected to be associated with lower quantities of services taken. Under conventional demand theory the satisfaction maximizing individual balances extra costs against extra benefits. With the assumption of diminishing marginal utility an increase in price results in a reduction in the quantity taken. However, since medical services are generally considered a necessity, the magnitude of the price coefficient should be small; that is, medical services are expected to be fairly price inelastic.

The relationship between price and quantity of medical services has been difficult to estimate empirically. The problem of differing fee schedules among practitioners may be overcome by the use of relative value scales. However, there still remains the difficulty of knowing whether and what amount the patient was actually charged. The practice of applying the fee schedule on a sliding scale is widespread. In addition, private insurance may cover all or part of the bill.

Under universal comprehensive insurance, in the absence of co-insurance, deductibles, and extra billing the marginal cost to the patient of extra services is zero. There are some circumstances, however, in the Saskatchewan setting where the patient may incur a

¹⁴A number of studies have shown that the role of explanatory variables may vary from one type of medical service to another. For example, see P. J. Feldstein and Ruth Severson, "The Demand for Medical Care," in American Medical Association, Report of the Commission on the Costs of Medical Care, I (Chicago: by the Association, 1964), 57-76; Grover C. Wirick, "A Multiple Equation Model of Demand," Health Services Research, I (Winter 1966), 301-46.

direct charge for services, in addition to the utilization fee after it was introduced. A patient may be billed directly by the physician at 100 per cent of the fee schedule. When the patient submits the claim to the Medical Care Insurance Commission he is reimbursed at the appropriate proportion of the fee schedule (usually 85 per cent). He therefore incurs an out-of-pocket charge of 15 per cent of the claim. This direct charge may be expected to deter consumption of services in a similar manner as a price. Therefore, the coefficient on the direct charge variable should be small and negative in sign.

3. Socio-Demographic Variables--The socio-demographic variables available in this study are age of family head, presence of spouse, number of children, location, and welfare status. These factors are not causes of medical care expenditure per se but rather are proxies of preferences and "needs" for medical care.¹⁶ Included in tastes and preferences are illness level or physiological need, and attitudes and perceptions toward medical care. Age, sex, marital status, and size of family are used as indicators of need. It is recognized that these variables are poor indicators of physiological need. Consequently the proportion of variation in medical expenditure that is explained by them is likely to be small. Psychological needs are, of course, difficult to measure and certainly no appropriate proxies seem to be available.

While age and sex information is available for all members of the family, only the age of family head is used. The sex of the head of family is used when the spouse is absent. The age of the head of family should be highly correlated with the ages of the members of the

¹⁶See Ronald Andersen and Lee Benham, op. cit., p. 81.

family and is therefore taken as a satisfactory index of family age. The relationship between age and medical care utilization is well known. Usage tends to decline at first with age and then to increase. At the low end of the age scale high medical expense is expected in the childbearing years. The highest usage is expected among the aged as they become more susceptible to accidents and chronic illness.

Marital status will presumably be important in those kinds of services which depend upon the availability of nursing services. Hospital services, for example, are commonly found to be greater among non-marrieds. The relationship between number of children and medical expenditure is expected to be positive; however, extra expenditure for additional children is expected to decline.

The location variable may be considered a proxy for availability of services. Since services are more available in urban areas, a positive sign is expected on this variable.

CHAPTER V

REGRESSION RESULTS

Regression models of the form described in the previous chapter were fitted to a variety of sets of the variables for total medical expenditure and its components for each of the years 1963 to 1967. The purpose of this chapter is to present the estimates of the effects of the explanatory variables on family medical expense. Several aspects of this analysis are unique. First, it is possible to include family income as an explanatory variable and to examine the behaviour of the coefficient for this variable using the repeated cross section data for several consecutive years. Second estimates of the degree of influence of a number of socio-demographic variables are obtained. These estimates are also obtained for a sequence of years enabling an examination of their variation over time. As mentioned in the previous chapter, estimates of the explanatory role of such variables has been the object of a number of previous studies. The regression model used in this analysis was chosen to allow comparison with the results of a major study done for a neighbouring province.¹ Other than for comments on this comparison, only a brief discussion of the coefficients will be presented. Tables will be presented here, and in the Statistical

¹C. H. Berry, Voluntary Medical Care Insurance and Prepayment (Ottawa: Queen's Printer, 1964).

Appendix, which the reader may examine for greater detail. Of primary concern here is the development of a set of coefficients that may be used in the next chapter to predict family medical expenditure for 1968.

The order of presentation of the regression results is as follows. First, estimates for expenditures on all services are presented for 1963, the earliest full calendar year of operation of the Medical Care Insurance Plan. Next, estimates for equations similar to those fitted to Manitoba data for 1961 are discussed. Third, equations are fitted to the data for each of the years 1963 to 1967 and the behaviour of the coefficients over time is examined. Fourth, similar equations are fitted to the data for selected components of medical care expense for each of those years. Next, the data is disaggregated by type of practitioner and separate equations are fitted to expenditures for general practitioners' services and specialists' services. Finally, some distributional aspects of the analysis are considered.

Expenditure on All Services 1963

An equation of the following form was fitted to the 1963 data on family medical expenditures for all services:²

$$FAPP_i = a_0 + a_1 \text{TOTINC} + a_2 \text{DCG} + a_3 \text{VAR001} + \dots + u_i$$

The estimated coefficients and their standard error for this regression model are presented in Table 5.1. Because of the way dummy variables are constructed a special interpretation must

²The variables are as defined in Table 4.1, Chapter Four, with u_i as an error term.

TABLE 5.1
REGRESSION COEFFICIENTS, EXPENDITURE ON
ALL SERVICES, 1963

	Coefficients	Standard Errors
Intercept	19.44	
Family Income	.00117	.00012
Elasticity	(.054)	
Direct Charge	6.58	0.09
Spouse Absent		
Single Male	-18.70	1.22
Single Female	-23.28	1.22
Children Present		
One	14.16	1.40
Two	11.93	1.53
Three	14.47	1.76
Four	11.54	2.08
Five Plus	25.58	2.06
Age of Family Head		
25-34	11.64	1.50
35-44	12.17	1.57
45-54	14.15	1.52
55-64	25.00	1.55
65-74	29.42	1.68
75 +	23.75	1.73
Urban	7.44	0.87
R ²	.24	

be placed on statistical significance as indicated by the standard errors in this and other similar equations that follow. The statistical significance of a given variable, say presence of spouse, is not indicated by the standard errors. The null hypothesis in such a case is the composite hypothesis that $a_0 = a_3 = a_4 = 0$ since the dummy variable is a tandem variable. The statistical significance of a given dummy variable, say single female, refers to the significance of the differential effect between single females and couples. However, a simultaneous statement cannot be made about the significance of the dummy variable for couples and the dummy variable for single females.

In interpreting the coefficients, the intercept is a point estimate of the expected average family expenditure for a couple with no children and with a head aged 18-24 years. The other coefficients for the dummy variables on number of children and age of family head are the amounts by which the intercept must be increased or decreased to get a point estimate for each family type.³ There are few surprises in these coefficients. The estimated expense for single females is less than for single males, a result which is expected.⁴ The effects

³The first differences of the coefficients for number of children are presented since the dummy variable scheme used does not yield marginal effects. This form of the dummy variable data matrix was selected to reduce computational costs. Hereafter all the coefficients for number of children are presented as differences. In considering the statistical significance of these coefficients as indicated by their standard errors, it must be remembered that they are presented as first differences in these tables. Thus the original coefficient for three children was one child plus two children plus three children or $14.16 + 11.93 + 14.47 = 40.56$; its standard error is 1.76.

⁴The fact that the estimated expense for single females aged 18-24 with no children is less than zero may be due to nonlinearity. A priori, expense cannot be negative.

of increasing age are linear rather than the expected pattern of high expense for the young and the old. The coefficient for the location variable indicates that families in urban settings spend on the average about \$7.44 more on medical care than do families living in rural areas. This is not unexpected. The greater relative availability of medical services in cities along with shorter distances may account for this difference. In addition, in rural areas x-rays and laboratory work may be done in the hospital and, therefore, is not charged to the Medical Care Commission.⁵

The coefficients of particular interest in this analysis are those for family income and direct charges. The sign of the income coefficient is positive indicating a direct relation between income and medical expense. The magnitude of the coefficient, however, is small. The size of the coefficient suggests that for an income increase of \$1000 family medical expenditure would increase by \$1.17. This yields an income elasticity of 0.05. The low income elasticity suggests that medical care insurance is successful in the sense that income ceases to be a major explanatory variable. That is, changes in income, on the average, do not give rise to very large changes in medical expenditure. Since the objective of insurance is to reduce the role of income, it may be said that the size of this coefficient is consistent with the successful operation of the insurance scheme.

The coefficient for direct charges is surprising both in sign and in magnitude. The coefficient indicates that for each extra dollar spent as a result of direct billing an additional \$6.58 is spent

⁵See Table 5.10 for the rural-urban difference associated with laboratory services.

on medical services. This is contrary to expectations. The common hypothesis is that when medical services are rendered without direct charges on the patient utilization increases. Therefore, when direct charges are incurred utilization should decrease.

A possible explanation for the coefficient on the direct charge variable may lie in the patterns of practice of those physicians who bill their patients directly.⁶ Only 10.1 per cent of the claims paid in 1963 were received directly from the patient.⁷ A small number of physicians who bill all, or most, of their patients directly could, therefore, account for a large part of the direct billing. If these physicians have high "generated costs" per patient this could account for the sign and magnitude of the estimated coefficient. Generated costs are payments for services that the physician requests for the patient. They are a result of physician decisions. It is unlikely that the patient would fail to have such services merely because the physician who ordered them billed the patient directly. Thus, even in the event of direct charges extra expenses by the patient are incurred. A study of physicians who submitted at least 80 per cent of their claims directly to the patient indicated that such physicians had very high generated costs per patient.⁸ While the study was based upon a small

⁶ There is an element of the whole-part problem here. That is, DCG is a part of family expenditure and to this extent a spurious positive correlation between the two may occur. However, under the hypothesis that a direct charge discourages utilization, and since the time period for these variables is one year, it is possible to have a negative correlation between DCG and utilization.

⁷ Medical Care Insurance Commission, Annual Report 1964 (Regina: Queen's Printer), Table 8, p. 27. This proportion declined continuously to 4.2% in 1967.

⁸ Medical Care Insurance Commission, "Comparison of Costs per Patient for Physicians' Billing Mode 3 with Other Modes" (unpublished, Regina, 1969).

number of physicians and was, therefore, not strongly conclusive, the results on the direct charge variable found in this study are consistent with the tentative hypothesis that physicians who bill directly have high generated costs per patient.

A Comparison with Manitoba Estimates

As a check on the regression results obtained from the Saskatchewan data, equations were estimated for the more restricted set of variables used by C. H. Berry in his study of household utilization of medical services in Manitoba for the Hall Commission. Using data supplied by Manitoba Medical Services for 1961, Berry estimated coefficients for age of family head, number of children, and presence of spouse. In addition, Berry estimated an equation for Saskatchewan using data supplied by Medical Services Incorporated, Saskatoon.

There are a number of factors, of course, that must be considered in comparing such estimates. Berry notes most of them in discussing the generality of the Manitoba experience.⁹ First, the Manitoba plan was a voluntary scheme and is subject to adverse risk selection. Those with low expected medical expenditures are less likely to join the plan. Second, the data for the Manitoba study covers only persons receiving care in the Winnipeg Metropolitan area. Third, the Manitoba fee schedule is higher "perhaps by as much as 10 per cent."¹⁰ Finally, coverage differences occur between the plans. No attempt will be made to discuss in detail such differences. Berry noted, however, that "the M.C.I.C. benefits appear to be more inclusive

⁹C. H. Berry, op. cit., p. 161.

¹⁰Ibid., p. 161.

than the M.S.I. Plans B and C, but still somewhat less comprehensive than the Manitoba Plan HCX."¹¹

Berry's estimates, based upon the 1961 data for Manitoba and the data for the Saskatchewan M.S.I. plan, are reproduced in Table 5.2. In addition, estimates are presented in the table for a similar equation fitted to the 1963 Saskatchewan data used in this study. The form of the equation fitted to family expenditures on all services is:¹²

$$FAPP_i = a_0 + a_1 \text{VAR001} + a_2 \text{VAR002} + \dots + a_{14} \text{VAR014} + u_i$$

Several differences in the estimates may be noted. First, the patterns of extra expense associated with age of the family head and number of children are similar in all three cases, although none of the age variables were statistically significant in the M.S.I. equation. Second, a tendency for single females to have higher medical expense than single males occurs in both the M.S.I. and the 1963 Saskatchewan equations but not in the Manitoba equation. Third and most striking, is the differences in the magnitude of the coefficients. The Saskatchewan coefficients are considerably lower than either the Manitoba or the M.S.I. coefficients. Since the Saskatchewan data are for 1963 and the Manitoba data are for 1961, it is expected that the estimates for Saskatchewan would be higher at least by a growth factor. Part of the difference observed may be due to the inclusion of rural families in the Saskatchewan data. An additional factor is that the Saskatchewan data includes more families with zero expense. In 1963,

¹¹Ibid., p. 162.

¹²The variables are defined as in Table 4.1 in Chapter Four, with u_i as an error term.

TABLE 5.2
REGRESSION COEFFICIENTS, MANITOBA AND SASKATCHEWAN¹

	Manitoba ² 1961	Saskatchewan ³ M.S.I. 1961	Saskatchewan 1963
Intercept	65.71	54.93	39.00
Spouse Absent			
Single Male	-43.92 (-32.79)	-17.71 (- 2.98)	-21.44 (16.49)
Single Female	-36.91 (-34.38)	-25.44 (- 4.48)	-26.62 (20.88)
Children Present			
One	28.27 (22.30)	3.99 (.71)	15.26 (10.17)
Two	15.80 (11.98)	16.47 (3.04)	13.67 (8.34)
Three	17.07 (11.73)	30.47 (5.21)	16.92 (9.00)
Four	11.04 (5.36)	32.39 (4.43)	10.82 (4.85)
Five Plus	24.37 (8.88)	50.21 (5.18)	28.01 (12.62)
Age of Family Head			
25-34	8.77 (6.22)	- 9.85 (.00)	5.78 (3.85)
35-44	5.45 (3.76)	- 5.99 (.00)	5.31 (3.38)
45-54	15.56 (10.99)	- 7.20 (.00)	6.86 (4.54)
55-64	27.76 (18.52)	2.32 (.00)	18.44 (11.97)
65-74 ^a	40.83 (25.61)	9.79 (.00)	22.91 (13.64)

¹The t statistics are in brackets below the coefficients.

²Berry, *op. cit.*, p. 125.

³*Ibid.*, p. 159. This equation included three dummy variables for type of plan which are not reported above.

^aBerry's data did not contain individuals over 75 years of age. The equation in column three was estimated by dropping the dummy variable for age 75 plus.

15.4 per cent of Saskatchewan families and 12 per cent of the Manitoba families incurred no medical expense.¹³ The chief reason for larger divergence of the coefficients among the older age groups may be the voluntary nature of the Manitoba scheme.

Medical Care Insurance Commission data for the second quarter of 1963 were made available to Berry, but at that time they were not in such a form as to allow estimation of an equation similar to those presented above. Berry does compare the Manitoba and Saskatchewan experience by converting the data into a per capita cost estimate. He concludes that the "Saskatchewan experience in the second quarter of 1963, far from appearing low by M.M.S. standards, seems to have been unexpectedly high."¹⁴ The coefficients presented in Table 5.2 would suggest the opposite conclusion.

On the whole the similarity in structure of the coefficients from the Saskatchewan data and the coefficients from the Manitoba data lends credence to the estimates. A comparison of the 1963 equation for Saskatchewan with equations for 1964 through 1967 will be dealt with next.

Expenditures on All Services, 1963-1967

The estimated coefficients from fitting the regression model to the data for each of the years 1963 through 1967 are presented in Table 5.3.¹⁵ Over these years the fee schedule remained virtually

¹³Ibid., p. 161, n. 2, and Medical Care Insurance Commission, Annual Report 1963 (Regina: Queen's Printer), p. 11.

¹⁴Ibid., p. 165.

¹⁵The regression model in each case is the same as the equation presented on p. 77 except that the dependent variable is family expenditure on components of total expenditure.

TABLE 5.3
REGRESSION COEFFICIENTS, FAMILY EXPENDITURES ON
ALL SERVICES, BY YEAR

	1963	1964	1965	1966	1967
Intercept	19.44	23.42	30.70	29.02	46.91
Family Income	.00117 (0.00012)	.00137 (0.00012)	.00085 (0.00013)	.00045 (0.00013)	.00032 (0.00013)
Elasticity	(.054)	(.06)	(.04)	(.02)	(.02)
Direct Charge	6.58 (0.09)	6.90 (0.10)	7.36 (0.12)	8.20 (0.13)	8.42 (0.16)
Spouse Absent					
Single Male	-18.70 (1.22)	-21.40 (1.31)	-25.64 (1.43)	-25.73 (1.50)	-33.35 (1.64)
Single Female	-23.28 (1.22)	-25.40 (1.30)	-26.11 (1.46)	-24.00 (1.54)	-29.89 (1.68)
Children Present					
One	14.16 (1.40)	18.98 (1.52)	29.43 (1.68)	27.97 (1.78)	30.22 (2.01)
Two	11.93 (1.53)	12.95 (1.67)	16.07 (1.85)	15.25 (1.95)	10.43 (2.17)
Three	14.47 (1.76)	14.34 (1.91)	10.92 (2.11)	13.99 (2.22)	23.21 (2.50)
Four	11.54 (2.08)	17.62 (2.26)	10.18 (2.49)	17.59 (2.62)	16.20 (3.02)
Five Plus	25.58 (2.06)	18.51 (2.24)	25.90 (2.45)	16.69 (2.58)	13.77 (3.04)
Age of Family Head					
25-34	11.64 (1.50)	10.60 (1.60)	7.84 (1.83)	4.22 (1.92)	-11.63 (2.09)
35-44	12.17 (1.57)	10.47 (1.70)	7.46 (1.93)	12.46 (2.04)	2.70 (2.23)
45-54	14.15 (1.52)	13.27 (1.65)	11.07 (1.86)	15.20 (1.96)	6.55 (2.10)
55-64	25.00 (1.55)	24.60 (1.65)	23.79 (1.85)	29.10 (1.93)	17.52 (2.08)
65-74	29.42 (1.68)	35.31 (1.78)	37.58 (1.98)	44.96 (2.05)	33.23 (2.23)
75 +	23.75 (1.73)	30.08 (1.79)	28.79 (1.96)	46.34 (2.01)	38.72 (2.17)
Urban	7.44 (0.87)	9.32 (0.93)	10.85 (1.03)	11.68 (1.08)	11.99 (1.17)
R ²	0.24	0.23	0.22	0.21	0.18

constant and only minor changes in coverage occurred.

Changes in the coefficients over time reflect the effects of experience with medical care insurance. Discussion will be confined to the economic significance of the behaviour of the coefficients over time. No statistical tests of the stability of these coefficients have been performed.¹⁶

The coefficient for the income variable is consistent in sign although the magnitude declines over time. In 1964 an extra \$1000 of income is associated with an extra \$1.37 medical expense. By 1967 the same increase in income would yield only \$0.32 of medical expense. This behaviour of the income coefficient supports the hypothesis that under insurance income ceases to be an effective constraint to consumption of medical services. The introduction of insurance removes the effect of income as a barrier to services. Income, however, still plays an explanatory role as a proxy of tastes or habits formed prior to insurance. With increased familiarity these habits are eroded and the size of the income coefficient declines. Thus a possible explanation of the decline in the income coefficient is the negative learning hypothesis discussed in Chapter Four.¹⁷

The behaviour of the direct charge coefficient is fairly consistent over time. There is a continuous increase in the coefficient from 1963 to 1967 although the rate of increase declines from 1966 to

¹⁶These tests are not performed because of the cost of computing a correlation matrix for the pooled sample. For a discussion of the appropriate tests see Gregory C. Chow, "Tests of Equality Between Sets of Coefficients in Two Linear Regressions," Econometrica, XXVIII, No. 3, (July 1960), 591-605.

¹⁷See p. 72.

1967. Nothing here contradicts the suggestion above that these coefficients reflect higher generated costs per patient by physicians who bill their patients directly.

The coefficients for the location variable indicate a growing differential between rural and urban families in utilization of medical services. In 1963 urban families spent on the average an estimated \$7.44 more on medical services than did rural families. By 1967 this difference grew to \$11.99. Whether or not this can be explained by availability of services is a question that will be dealt with when the components of medical services are examined.

Turning to the variables describing family characteristics, many of the conclusions reached in examining 1963 alone remain unaffected. The extra cost of additional children is positive but declines with additional children, although 1964 and 1967 do not conform to this pattern. Only in two of the years, 1964 and 1965, is a U-shaped relationship between age and medical expense indicated as in the Manitoba estimates. The remaining three years suggest a linear relation between age of the family head and family medical expense. Another feature of the age coefficients is that the average expense for ages greater than 75 years declines in each of the years 1963 to 1965. For 1966 and 1967, however, expenditure increases throughout all age levels. This difference may be associated with the inclusion of recipients of welfare assistance as beneficiaries under the Medical Care Insurance Plan in April of 1966.

The coefficients for the single male and single female variables also show an interesting reversal. Prior to 1966, the estimates of average expense were higher for single males than for

single females, a finding contrary to the Manitoba experience and contrary to expectation. By 1966 the relative size of the estimates is reversed so that average expense for single females is greater than that for single males.

Further information on the effects of these explanatory variables can be obtained by examining expenditures for the components of medical care.

Expenditures on Selected Components of
Medical Care, 1963-1967

Tables 5.4 to 5.14 contain the estimated coefficients and their standard errors for selected components of medical expenditure. The composition of each of the components has been noted earlier.¹⁸ No comparison is offered with the Berry study since the composition of his groups are not similar. Comment here will be confined to a few selected features in the tables.

The coefficients for age in the complete examinations equations, and to a lesser extent in the regional examinations equations, show a tendency to decline over time. This may reflect a backlog of demand at the time of introduction of the insurance plan. The income coefficients also show the same tendency although the amount of the reduction is greater for regional examinations. Finally, the sign of the coefficient on location suggests that urban families receive more complete examinations but less regional examinations than do rural families.

The coefficients for home and emergency visits, with the exception of those for age, on the other hand, show a tendency to

¹⁸ See Chapter Three, p. 55.

TABLE 5.4
REGRESSION COEFFICIENTS, EXPENDITURES
ON COMPLETE EXAMINATIONS, BY YEAR

	1963	1964	1965	1966	1967
Intercept	2.24	2.55	3.03	2.53	4.09
Family Income	.00012 (0.00001)	.00010 (0.00001)	.00009 (0.00001)	.00009 (0.00001)	.00008 (0.00001)
Direct Charge	6.26 (0.11)	6.63 (0.12)	6.60 (0.14)	6.93 (0.15)	6.61 (0.17)
Spouse Absent					
Single Male	-1.98 (0.11)	-2.14 (0.11)	-2.45 (0.12)	-2.28 (0.11)	-2.94 (0.12)
Single Female	-1.84 (0.11)	-2.13 (0.11)	-2.20 (0.12)	-1.90 (0.12)	-2.31 (0.12)
Children Present					
One	0.94 (0.12)	1.32 (0.13)	2.08 (0.14)	1.69 (0.13)	1.82 (0.15)
Two	1.01 (0.14)	1.09 (0.14)	1.16 (0.15)	1.41 (0.15)	1.21 (0.16)
Three	0.49 (0.16)	0.77 (0.16)	0.59 (0.17)	1.07 (0.17)	1.34 (0.18)
Four	0.86 (0.18)	0.79 (0.19)	0.76 (0.20)	0.55 (0.20)	0.15 (0.22)
Five Plus	0.96 (0.18)	0.48 (0.19)	0.87 (0.20)	0.62 (0.19)	0.86 (0.22)
Age of Family Head					
25-34	0.64 (0.13)	0.30 (0.14)	0.25* (0.15)	-0.19 (0.14)	-.132 (0.15)
35-44	1.38 (0.14)	1.05 (0.14)	0.56 (0.16)	0.65 (0.15)	-0.14* (0.16)
45-54	1.43 (0.14)	1.47 (0.14)	1.09 (0.15)	1.29 (0.15)	0.35 (0.15)
55-64	2.07 (0.14)	1.97 (0.14)	1.44 (0.15)	1.61 (0.14)	0.69 (0.15)
65-74	1.84 (0.15)	2.07 (0.15)	1.90 (0.16)	2.22 (0.16)	1.47 (0.16)
75 +	0.95 (0.15)	1.14 (0.15)	0.70 (0.16)	1.54 (0.15)	1.12 (0.16)
Urban	0.35 (0.08)	0.58 (0.08)	1.02 (0.08)	1.41 (0.08)	1.51 (0.08)
R ²	0.17	0.16	0.17	0.17	0.15

*Not significant at the 5% level.

TABLE 5.5
REGRESSION COEFFICIENTS, EXPENDITURES
ON REGIONAL EXAMINATIONS, BY YEAR

	1963	1964	1965	1966	1967
Intercept	5.02	6.50	8.96	9.50	12.59
Family Income	.00031 (0.00002)	.00032 (0.00002)	.00022 (0.00002)	.00007 (0.00002)	.00005 (0.00002)
Direct Charge	4.77 (0.12)	4.66 (0.13)	4.35 (0.16)	4.48 (0.20)	5.36 (0.22)
Spouse Absent					
Single Male	-4.90 (0.23)	-5.78 (0.24)	-6.97 (0.26)	-7.67 (0.29)	-8.52 (0.28)
Single Female	-4.57 (0.22)	-5.32 (0.24)	-5.57 (0.27)	-5.39 (0.30)	-6.10 (0.29)
Children Present					
One	2.31 (0.26)	3.18 (0.28)	5.34 (0.31)	5.70 (0.34)	6.35 (0.34)
Two	3.43 (0.28)	4.25 (0.30)	3.97 (0.34)	4.99 (0.38)	4.02 (0.37)
Three	2.92 (0.32)	3.12 (0.35)	3.24 (0.39)	2.87 (0.43)	3.76 (0.43)
Four	1.55 (0.38)	1.89 (0.41)	2.55 (0.46)	3.96 (0.50)	3.31 (0.51)
Five Plus	2.51 (0.38)	1.89 (0.41)	2.54 (0.45)	2.67 (0.50)	3.12 (0.52)
Age of Family Head					
25-34	2.48 (0.28)	1.88 (0.29)	1.13 (0.34)	0.36* (0.37)	-2.88 (0.36)
35-44	3.69 (0.29)	2.68 (0.31)	2.06 (0.36)	3.07 (0.39)	0.62 (0.38)
45-54	3.54 (0.28)	2.99 (0.30)	2.44 (0.34)	3.22 (0.38)	1.17 (0.36)
55-64	5.05 (0.29)	5.28 (0.30)	4.55 (0.34)	5.33 (0.37)	2.95 (0.35)
65-74	5.57 (0.31)	6.60 (0.32)	6.32 (0.36)	7.75 (0.40)	5.83 (0.38)
75 +	3.89 (0.32)	3.98 (0.33)	2.92 (0.36)	5.53 (0.39)	3.69 (0.37)
Urban	0.00 (0.00)	-0.12* (0.17)	-0.38 (0.19)	-1.15 (0.21)	-1.02 (0.20)
R ²	0.19	0.20	0.20	0.20	0.20

*Not significant at the 5% level.

TABLE 5.6
REGRESSION COEFFICIENTS, EXPENDITURES
ON HOME AND EMERGENCY VISITS, BY YEAR

	1963	1964	1965	1966	1967
Intercept	0.64	1.16	1.98	1.92	2.67
Family Income	.00017 (0.00001)	.00012 (0.00001)	.00005 (0.00001)	.00002* (0.00002)	.00002 (0.00001)
Direct Charge	6.41 (0.12)	6.95 (0.16)	6.82 (0.17)	7.69 (0.26)	8.11 (0.32)
Spouse Absent					
Single Male	-0.90 (0.14)	-0.96 (0.16)	-1.33 (0.16)	-1.42 (0.18)	-1.35 (0.18)
Single Female	-0.99 (0.14)	-1.06 (0.16)	-1.20 (0.16)	-0.89 (0.18)	-0.86 (0.19)
Children Present					
One	1.14 (0.16)	1.80 (0.18)	2.33 (0.18)	2.42 (0.21)	2.43 (0.22)
Two	1.24 (0.18)	1.01 (0.20)	1.28 (0.20)	1.45 (0.23)	1.49 (0.24)
Three	1.50 (0.20)	1.45 (0.23)	0.66 (0.23)	1.43 (0.26)	1.57 (0.28)
Four	0.93 (0.24)	0.87 (0.27)	1.82 (0.27)	1.86 (0.31)	0.81 (0.34)
Five Plus	1.38 (0.24)	1.94 (0.27)	1.70 (0.27)	1.32 (0.30)	2.52 (0.34)
Age of Family Head					
25-34	1.19 (0.17)	0.93 (0.19)	0.96 (0.20)	0.62 (0.23)	-0.32* (0.23)
35-44	0.60 (0.18)	0.33* (0.21)	0.07* (0.21)	0.55 (0.24)	-0.23* (0.25)
45-54	0.04* (0.18)	-0.39* (0.20)	-0.82 (0.20)	-0.42* (0.23)	-0.91 (0.23)
55-64	0.55 (0.18)	0.38* (0.20)	0.05* (0.20)	0.44* (0.23)	0.24* (0.23)
65-74	1.38 (0.20)	1.97 (0.22)	1.60 (0.22)	2.19 (0.24)	1.77 (0.25)
75 +	2.64 (0.20)	3.43 (0.22)	3.21 (0.22)	5.66 (0.24)	6.42 (0.24)
Urban	0.77 (0.10)	0.33 (0.11)	0.04* (0.11)	0.06* (0.13)	-0.32 (0.13)
R ²	0.13	0.09	0.10	0.09	0.07

*Not significant at the 5% level.

TABLE 5.7
REGRESSION COEFFICIENTS, EXPENDITURES ON
HOSPITAL VISITS, BY YEAR

	1963	1964	1965	1966	1967
Intercept	2.16	2.31	3.60	3.10	4.26
Family Income	-.00006 (0.00003)	-.00005 (0.00003)	-.00016 (0.00003)	-.00014 (0.00003)	-.00020 (0.00003)
Direct Charge	7.34 (0.08)	7.34 (0.09)	8.01 (0.12)	8.32 (0.15)	7.83 (0.18)
Spouse Absent					
Single Male	-0.34* (0.30)	-0.29* (0.34)	-1.12 (0.36)	-0.31* (0.40)	-0.97 (0.41)
Single Female	-1.82 (0.30)	-2.06 (0.33)	-2.53 (0.37)	-1.62 (0.41)	-2.38 (0.42)
Children Present					
One	2.10 (0.34)	3.17 (0.39)	3.16 (0.43)	4.20 (0.47)	3.42 (0.50)
Two	-0.04 (0.38)	-0.44 (0.43)	0.23 (0.47)	-0.64 (0.50)	-0.26 (0.54)
Three	1.70 (0.43)	1.72 (0.49)	1.68 (0.53)	1.38 (0.57)	2.13 (0.63)
Four	2.42 (0.51)	1.73 (0.58)	1.11 (0.63)	1.99 (0.67)	2.62 (0.76)
Five Plus	3.56 (0.51)	4.25 (0.58)	4.29 (0.62)	3.02 (0.65)	3.58 (0.76)
Age of Family Head					
25-34	0.85 (0.37)	0.97 (0.41)	0.93 (0.46)	0.49* (0.42)	-0.26* (0.52)
35-44	0.40* (0.39)	0.11* (0.44)	-0.19* (0.49)	0.0* (0.00)	-0.10* (0.56)
45-54	1.21 (0.38)	1.10 (0.42)	0.56* (0.47)	0.78* (0.43)	0.80* (0.53)
55-64	4.14 (0.38)	3.83 (0.43)	4.43 (0.47)	4.05 (0.45)	4.03 (0.52)
65-74	5.98 (0.41)	8.40 (0.46)	8.51 (0.50)	10.35 (0.51)	9.06 (0.56)
75 +	8.45 (0.43)	10.65 (0.46)	11.46 (0.50)	18.33 (0.50)	18.21 (0.54)
Urban	-1.11 (0.22)	-1.13 (0.24)	-1.83 (0.26)	-2.20 (0.29)	-1.97 (0.29)
R ²	0.20	0.17	0.14	0.12	0.09

*Not significant at the 5% level.

TABLE 5.8
REGRESSION COEFFICIENTS, EXPENDITURES ON
CONSULTATIONS, BY YEAR

	1963	1964	1965	1966	1967
Intercept	0.29	0.37	0.59	0.78	1.18
Family Income	.00010 (0.00001)	.00009 (0.00001)	.00006 (0.00001)	.00004 (0.00001)	.00002 (0.00001)
Direct Charge	6.95 (0.08)	7.42 (0.08)	7.23 (0.09)	7.57 (0.10)	7.93 (0.12)
Spouse Absent					
Single Male	-0.63 (0.09)	-0.73 (0.10)	-0.93 (0.11)	-1.07 (0.12)	-1.29 (0.13)
Single Female	-0.73 (0.09)	-0.97 (0.10)	-0.93 (0.11)	-1.10 (0.12)	-1.34 (0.14)
Children Present					
One	0.23 (0.11)	0.45 (0.12)	0.96 (0.13)	0.92 (0.14)	0.94 (0.16)
Two	0.39 (0.12)	0.12 (0.13)	0.28 (0.14)	0.39 (0.16)	0.59 (0.18)
Three	0.22 (0.13)	0.56 (0.15)	0.29 (0.16)	0.14 (0.18)	0.73 (0.20)
Four	-0.11 (0.16)	0.11 (0.18)	0.15 (0.19)	0.63 (0.21)	0.41 (0.24)
Five Plus	0.57 (0.16)	0.24 (0.17)	0.43 (0.19)	-0.14 (0.21)	-0.12 (0.25)
Age of Family Head					
25-34	0.24 (0.12)	0.27 (0.12)	0.12* (0.14)	0.25* (0.15)	-0.16* (0.17)
35-44	0.74 (0.12)	0.51 (0.13)	0.51 (0.15)	0.80 (0.16)	0.84 (0.18)
45-54	0.66 (0.12)	0.74 (0.13)	0.70 (0.14)	0.96 (0.16)	0.74 (0.17)
55-64	1.06 (0.12)	1.16 (0.13)	0.99 (0.14)	1.28 (0.16)	1.18 (0.17)
65-74	1.38 (0.13)	1.66 (0.14)	1.62 (0.15)	1.98 (0.16)	1.88 (0.18)
75 +	0.74 (0.13)	1.19 (0.14)	1.22 (0.15)	1.62 (0.16)	1.62 (0.18)
Urban	0.89 (0.07)	1.07 (0.07)	1.16 (0.08)	1.20 (0.09)	1.82 (0.10)
R ²	0.19	0.20	0.18	0.16	0.14

*Not significant at the 5% level.

TABLE 5.9

REGRESSION COEFFICIENTS, EXPENDITURES ON
PSYCHIATRIC SERVICES, BY YEAR

	1963	1964	1965	1966	1967
Intercept	-0.07	-0.01	0.11	-0.32	0.37
Family Income	.00001* (0.00001)	.00001* (0.00001)	.00001* (0.00002)	.00003 (0.00001)	.00000* (0.00002)
Direct Charge	8.82 (0.33)	6.90 (0.14)	7.01 (0.16)	7.35 (0.09)	7.33 (0.08)
Spouse Absent					
Single Male	-0.20* (0.11)	-0.15* (0.14)	-0.21* (0.17)	0.17* (0.18)	-0.19* (0.20)
Single Female	-0.23 (0.11)	0.20* (0.14)	0.16* (0.18)	0.16* (0.18)	0.0* (0.00)
Children Present					
One	0.04* (0.12)	0.22* (0.16)	0.35* (0.20)	0.54* (0.21)	0.0* (0.00)
Two	-0.08* (0.13)	-0.05* (0.12)	0.14* (0.22)	-0.13* (0.23)	0.60 (0.28)
Three	-0.01* (0.15)	0.13* (0.20)	0.16 (0.26)	0.57 (0.26)	0.55 (0.32)
Four	-0.07* (0.18)	0.25 (0.24)	-0.36* (0.30)	-0.09 (0.31)	-0.09 (0.40)
Five Plus	0.0* (0.00)	-0.45* (0.24)	-0.14* (0.30)	-0.68* (0.30)	-0.58* (0.40)
Age of Family Head					
25-34	0.29 (0.14)	0.08* (0.17)	-0.11* (0.22)	0.37* (0.22)	0.05* (0.28)
35-44	0.70 (0.14)	0.47 (0.12)	0.06* (0.23)	0.48 (0.24)	0.34* (0.30)
45-54	0.30 (0.14)	0.61 (0.17)	0.57 (0.23)	0.87 (0.23)	0.21* (0.28)
55-64	0.37 (0.14)	0.36 (0.18)	0.36* (0.22)	0.53 (0.23)	0.12* (0.28)
65-74	0.21* (0.15)	0.09* (0.19)	0.05* (0.24)	0.24* (0.24)	-0.42* (0.30)
75 +	0.13* (0.16)	0.05* (0.19)	-0.30* (0.24)	-0.03* (0.24)	-0.42* (0.29)
Urban	0.60 (0.08)	0.65 (0.10)	0.74 (0.13)	1.08 (0.13)	1.41 (0.16)
R ²	0.02	0.06	0.05	0.16	0.18

*Not significant at the 5% level.

TABLE 5.10
REGRESSION COEFFICIENTS, EXPENDITURES ON
LABORATORY SERVICES, BY YEAR

	1963	1964	1965	1966	1967
Intercept	-0.12	-0.066	0.26	-0.00073	1.63
Family Income	.00011 (0.00001)	.00027 (0.00001)	.00020 (0.00002)	.00019 (0.00002)	.00018 (0.00002)
Direct Charge	6.68 (0.08)	5.95 (0.09)	6.41 (0.12)	6.86 (0.10)	6.62 (0.12)
Spouse Absent					
Single Male	-0.75 (0.09)	-1.73 (0.15)	-2.36 (0.18)	-2.49 (0.18)	-3.37 (0.21)
Single Female	-0.94 (0.09)	-1.84 (0.15)	-2.22 (0.18)	-2.04 (0.19)	-2.76 (0.22)
Children Present					
One	0.45 (0.10)	0.83 (0.18)	1.32 (0.21)	1.32 (0.22)	1.30 (0.26)
Two	0.65 (0.11)	0.97 (0.20)	1.07 (0.23)	1.08 (0.24)	1.21 (0.28)
Three	0.04 (0.13)	0.30 (0.22)	0.31 (0.26)	0.55 (0.27)	0.91 (0.32)
Four	0.13 (0.15)	-0.12 (0.26)	0.27 (0.31)	0.22 (0.32)	-0.14 (0.39)
Five Plus	0.11 (0.15)	0.38 (0.26)	-0.41 (0.31)	-0.06 (0.32)	0.24 (0.39)
Age of Family Head					
25-34	0.50 (0.11)	0.59 (0.19)	0.40* (0.23)	0.47* (0.24)	-0.85 (0.27)
35-44	1.18 (0.11)	1.75 (0.20)	2.18 (0.24)	2.45 (0.25)	2.16 (0.29)
45-54	1.15 (0.11)	2.30 (0.19)	2.98 (0.23)	3.11 (0.24)	2.68 (0.27)
55-64	1.60 (0.11)	3.19 (0.19)	3.42 (0.23)	3.66 (0.24)	3.33 (0.27)
65-74	1.58 (0.12)	3.02 (0.21)	3.80 (0.25)	4.50 (0.25)	4.43 (0.29)
75 +	1.02 (0.13)	1.67 (0.21)	1.72 (0.24)	2.81 (0.25)	2.18 (0.28)
Urban	1.91 (0.06)	4.09 (0.11)	5.20 (0.13)	5.51 (0.13)	5.99 (0.15)
R ²	0.22	0.19	0.15	0.19	0.15

*Not statistically significant at the 5% level.

TABLE 5.11
REGRESSION COEFFICIENTS, EXPENDITURES ON
MAJOR SURGERY, BY YEAR

	1963	1964	1965	1966	1967
Intercept	4.12 [*]	5.06	5.12	5.85	9.54
Family Income	.00021 (0.00007)	.00027 (0.00006)	.00021 (0.00007)	.00006* (0.00007)	.00020 (0.00007)
Direct Charge	6.90 (0.08)	6.89 (0.08)	6.90 (0.10)	7.28 (0.12)	7.04 (0.13)
Spouse Absent					
Single Male	-4.99 (0.68)	-5.58 (0.69)	-5.90 (0.79)	-6.37 (0.84)	-8.51 (0.88)
Single Female	-7.59 (0.67)	-7.37 (0.68)	-7.41 (0.80)	-8.01 (0.86)	-9.16 (0.90)
Children Present					
One	3.76 (0.77)	3.46 (0.80)	5.10 (0.93)	4.13 (1.00)	5.20 (1.08)
Two	-0.65 (0.85)	0.69 (0.88)	4.14 (1.02)	5.00 (1.09)	1.66 (1.16)
Three	3.44 (0.97)	2.75 (1.01)	2.82 (1.16)	3.11 (1.24)	8.78 (1.33)
Four	2.07 (1.15)	6.21 (1.20)	-0.07 (1.37)	3.31 (1.46)	5.76 (1.61)
Five Plus	8.72 (1.14)	3.82 (1.18)	9.40 (1.35)	5.61 (1.44)	-0.46 (1.63)
Age of Family Head					
25-34	1.40* (0.83)	1.58* (0.85)	1.05* (1.01)	-0.61* (1.07)	-3.61 (1.12)
35-44	5.50 (0.87)	5.86 (0.90)	5.34 (1.06)	5.02 (1.14)	2.80 (1.18)
45-54	8.69 (0.84)	8.05 (0.87)	9.17 (1.02)	8.71 (1.10)	7.56 (1.12)
55-64	10.76 (0.86)	9.79 (0.88)	11.53 (1.02)	13.69 (1.08)	9.99 (1.11)
65-74	10.85 (0.93)	11.17 (0.94)	14.57 (1.09)	15.86 (1.15)	13.14 (1.19)
75 +	5.94 (0.95)	7.86 (0.95)	9.60 (1.08)	11.56 (1.12)	9.92 (1.16)
Urban	2.62 (0.48)	2.37 (0.49)	3.66 (0.57)	4.50 (0.60)	3.34 (0.62)
R ²	0.19	0.16	0.14	0.12	0.11

*Not statistically significant at the 5% level.

TABLE 5.12
REGRESSION COEFFICIENTS, EXPENDITURES ON
MINOR SURGERY, BY YEAR

	1963	1964	1965	1966	1967
Intercept	0.92	1.05	1.35	1.31	1.80
Family Income	.00005 (0.00001)	.00006 (0.00001)	.00006 (0.00001)	.00004 (0.00001)	.00002 (0.00001)
Direct Charge	6.44 (0.08)	6.69 (0.11)	6.45 (0.12)	6.52 (0.12)	6.98 (0.15)
Spouse Absent					
Single Male	-0.53 (0.07)	-0.58 (0.08)	-0.53 (0.09)	-0.71 (0.09)	-0.76 (0.10)
Single Female	-0.62 (0.07)	-0.66 (0.08)	-0.58 (0.10)	-0.64 (0.09)	-0.75 (0.10)
Children Present					
One	0.32 (0.08)	0.44 (0.09)	0.82 (0.11)	0.64 (0.11)	1.04 (0.12)
Two	0.52 (0.09)	0.68 (0.10)	0.79 (0.12)	0.78 (0.12)	0.92 (0.13)
Three	0.65 (0.10)	0.72 (0.11)	0.52 (0.14)	0.72 (0.13)	0.83 (0.15)
Four	0.69 (0.12)	0.78 (0.14)	0.89 (0.16)	0.71 (0.16)	0.66 (0.18)
Five Plus	0.70 (0.12)	0.91 (0.13)	0.91 (0.16)	1.56 (0.16)	0.99 (0.18)
Age of Family Head					
25-34	0.18 (0.09)	-0.09* (0.10)	-0.11* (0.12)	-0.31 (0.10)	-0.85 (0.13)
35-44	0.20 (0.09)	0.04* (0.10)	-0.12* (0.12)	0.10* (0.10)	-0.28 (0.13)
45-54	0.12* (0.09)	-0.01* (0.10)	-0.39 (0.12)	0.0 (0.00)	-0.41 (0.13)
55-64	0.18 (0.09)	0.07* (0.10)	-0.16* (0.12)	0.08* (0.10)	-0.40 (0.12)
65-74	0.09* (0.10)	-0.14* (0.11)	-0.22* (0.13)	p.02* (0.12)	-0.38 (0.14)
75 +	-0.06* (0.10)	-0.13* (0.11)	-0.32 (0.13)	-0.20* (0.12)	-0.45 (0.13)
Urban	-0.17 (0.05)	-0.09* (0.06)	-0.18 (0.07)	-0.04* (0.07)	-0.10* (0.07)
R ²	0.17	0.14	0.12	0.12	0.10

*Not statistically significant at the 5% level.

TABLE 5.13

REGRESSION COEFFICIENTS, EXPENDITURES ON
ANAESTHESIA, BY YEAR

	1963	1964	1965	1966	1967
Intercept	0.66	0.88	1.16	1.21	2.02
Family Income	.00006 (0.00001)	.00006 (0.00001)	.00004 (0.00001)	.00002 (0.00001)	.00001* (0.00002)
Direct Charge	6.68 (0.07)	6.90 (0.08)	6.68 (0.10)	7.16 (0.11)	6.97 (0.11)
Spouse Absent					
Single Male	-0.96 (0.14)	-0.95 (0.14)	-1.14 (0.16)	-1.43 (0.17)	-1.61 (0.17)
Single Female	-1.30 (0.14)	-1.20 (0.14)	-1.39 (0.17)	-1.18 (0.18)	-1.53 (0.17)
Children Present					
One	0.89 (0.16)	0.80 (0.16)	1.32 (0.19)	1.14 (0.20)	1.54 (0.21)
Two	0.02 (0.18)	0.45 (0.18)	0.94 (0.21)	0.92 (0.22)	0.08 (0.22)
Three	0.95 (0.20)	0.68 (0.20)	0.92 (0.24)	1.11 (0.25)	1.77 (0.26)
Four	0.50 (0.24)	1.27 (0.24)	0.06 (0.29)	0.79 (0.30)	2.03 (0.31)
Five Plus	1.55 (0.24)	1.01 (0.24)	2.08 (0.28)	0.88 (0.29)	-0.37 (0.32)
Age of Family Head					
25-34	0.61 (0.17)	0.53 (0.17)	0.38* (0.21)	0.05* (0.22)	-0.52 (0.22)
35-44	1.01 (0.18)	0.89 (0.18)	0.65 (0.22)	0.79 (0.23)	0.50 (0.23)
45-54	1.39 (0.18)	1.30 (0.18)	1.15 (0.21)	1.03 (0.22)	0.73 (0.22)
55-64	1.89 (0.18)	1.39 (0.18)	1.64 (0.21)	1.83 (0.22)	1.29 (0.21)
65-74	1.55 (0.20)	1.55 (0.19)	2.01 (0.23)	2.24 (0.23)	1.39 (0.23)
75 +	0.83 (0.20)	0.95 (0.19)	1.09 (0.23)	1.39 (0.23)	0.85 (0.22)
Urban	0.54 (0.10)	0.42 (0.10)	0.54 (0.12)	0.75 (0.12)	0.43 (0.12)
R ²	0.20	0.19	0.14	0.14	0.14

*Not statistically significant at the 5% level.

TABLE 5.14
REGRESSION COEFFICIENTS, EXPENDITURES ON
OBSTETRICS, BY YEAR

	1963	1964	1965	1966	1967
Intercept	3.57	3.52	4.72	3.49	6.31
Family Income	.00001* (0.00002)	0.0* (0.0)	-.00003* (0.00002)	-.00005 (0.00002)	-.00007 (0.00002)
Direct Charge	5.70 (0.08)	5.81 (0.08)	5.84 (0.11)	6.09 (0.14)	6.26 (0.14)
Spouse Absent					
Single Male	-1.85 [†] (0.25)	-1.71 (0.24)	-2.25 (0.25)	-2.12 (0.23)	-3.37 (0.23)
Single Female	-1.86 (0.24)	-1.53 (0.23)	-1.58 (0.26)	-1.00 (0.24)	-2.07 (0.23)
Children Present					
One	1.95 (0.28)	3.22 (0.28)	6.09 (0.29)	4.85 (0.28)	5.85 (0.28)
Two	5.15 (0.31)	3.77 (0.30)	1.34 (0.32)	-0.29 (0.30)	-2.46 (0.30)
Three	1.86 (0.35)	1.07 (0.35)	-0.29 (0.37)	0.90 (0.34)	1.23 (0.35)
Four	3.00 (0.42)	4.32 (0.41)	2.37 (0.47)	2.98 (0.41)	0.11 (0.42)
Five Plus	4.85 (0.42)	3.20 (0.41)	4.25 (0.43)	1.76 (0.40)	4.09 (0.42)
Age of Family Head					
25-34	2.88 (0.30)	3.15 (0.29)	2.51 (0.32)	2.40 (0.30)	-0.77 (0.29)
35-44	-4.46 (0.32)	-4.34 (0.31)	-4.84 (0.34)	-2.29 (0.32)	-4.21 (0.31)
45-54	-6.03 (0.31)	-6.34 (0.30)	-7.61 (0.32)	-5.10 (0.31)	-7.21 (0.29)
55-64	-4.20 (0.31)	-4.45 (0.30)	-5.94 (0.32)	-4.39 (0.30)	-6.47 (0.29)
65-74	-2.90 (0.34)	-3.09 (0.33)	-4.34 (0.35)	-3.30 (0.32)	-5.43 (0.31)
75 +	-2.30 (0.35)	-2.49 (0.33)	-3.71 (0.34)	-2.78 (0.31)	-4.74 (0.30)
Urban	-0.06* (0.18)	-0.18* (0.17)	-0.30 (0.18)	0.04* (0.17)	0.21* (0.16)
R ²	0.24	0.21	0.17	0.12	0.11

*Not significant at the 5% level.

[†]Positive levels of expenditure for single males may be due to the death of the spouse during childbirth, or separation or divorce shortly after the birth of a child.

increase over time. In the case of age, the 75 plus age coefficient also increases over time. The age relationship is obviously non-linear, although the minimum expenditure class tends to occur at an older age, 45-54 years than at the younger age classes. These results are weakened, however, by a lack of statistical significance of several of the individual age coefficients. Greater expense in the younger age classes together with single male expense in excess of single female expense may be explained by the incidence of accidents in the work force. The size of the rural-urban differential declines until the urban coefficient becomes negative indicating greater expense by rural families.

The coefficients for hospital visits behave over time in a manner similar to home and emergency visits. They increase with the exception of those of the lower age groups. The minimum expense class occurs earlier, however, probably reflecting maternity expenditures. Again, though, most of the age classes exhibit a lack of statistical significance of individual coefficients. The tendency for single males expenditure to exceed that for single females may again be due to accidents. The income variable's coefficient is negative in sign and increases in absolute value over time. The possible reasons for a negative sign on this coefficient have been discussed earlier. That is, hospitalization may involve loss of income due to absence from work. Alternatively, it may be argued, low income groups require more hospital based treatment.¹⁹ Finally, expense by families in rural areas tends to be greater than expense by urban families. This may

¹⁹See Chapter Four, p. 72.

be due to the high "bed/patient" ratio in Saskatchewan.

The coefficients for consultations indicate a positive relationship between income and expenditure. In addition, the size of the income coefficients shows a tendency to decline over time. The positive coefficient for the location variable reflects, no doubt, the greater relative accessibility of physicians in urban areas. The coefficients for absence of spouse, while statistically significant, are not very satisfactory since they indicate negative expenditure. This may again be attributable to nonlinearities.

Turning to psychiatric services, the results are not very satisfactory. Many coefficients are not significant. In addition, the coefficients for single male, single female, and couples are somewhat weakened by nonlinearities. Expense tends to peak at family sizes of three children and at the middle age classes 35-44 and 45-54 years. Evidently older people receive fewer psychiatric services; they are simply old.

The equations for laboratory services have a relatively high income coefficient, positive in sign. Further, there is a large rural-urban difference with urban families receiving substantially more laboratory work.²⁰ This could indicate over-servicing in urban areas or lower quality of care in rural areas. Expenditure on laboratory services tends to increase with age except for the age class 75 plus years, which again has interesting implications for quality care.

The coefficients for major surgery offer interesting comparisons

²⁰This difference is mitigated to some extent by the fact that some rural laboratory work may be done in the hospitals and, therefore, not charged to the Medical Care Insurance Commission.

with hospital visits, since such surgery would be hospital based. The income coefficient is positive in sign contrasted with a negative sign for hospital visits. If the negative sign of hospital visits is associated with income loss during confinement, presumably this would hold for major surgery also. But since the surgery coefficients are positive, the income loss hypothesis is excluded. It would appear then that the coefficients indicate different levels of utilization by income class. The rural-urban differential is relatively large suggesting that rural families do not seek or receive as much major surgical attention. On the other hand, the coefficients for minor surgery indicate the opposite, with rural families receiving more services than urban families. It is doubtful, but raises interesting questions, whether the deficit in major surgery is offset by minor surgery.

The coefficients for anaesthetic services suggest a positive relation between income and expenditure with the now familiar tendency of the relation to weaken over time. The fact that surgery is performed in urban centres accounts for the positive sign on the urban dummy since anaesthetic services are complementary to surgery. Negative expenditures are again indicated for the single male and single female categories, a result which has earlier been attributed to nonlinearities.

Finally, the coefficients for obstetrics indicate the expected tendency for expense to decline with age. In addition, there is a puzzling reversal of the marginal costs for the second child. In the first three years of the insurance plan's operation such extra costs are positive and then they become negative. This result may be due to a shift in billing practices of physicians, but this would require

further study. Finally, the location coefficient indicates small, and not statistically significant, differences between rural and urban families.

Expenditure on All Services by Type of
Practitioner, 1963-1967

A separate regression equation was fitted to the data for expenditures on all services rendered by general practitioners. Such an equation was estimated for the data for each of the years 1963 to 1967. Table 5.15 contains the estimated coefficients.

The behaviour of the income coefficient is particularly interesting. In the early years, the income coefficient, while positive in sign, is small and declines from 0.00041 in 1963 to zero in 1965.²¹ From 1966 onward there is a reversal in sign and the absolute value of the coefficient increases. That is, in these latter years increases in income tend to be associated with decreases in expenditures on general practitioners' services. Have general practitioners' services become an "inferior" good?

The behaviour of the coefficients for single male and single female are just the reverse of what was observed for expenditures on all services. The point estimate for single males' average expenditure on general practitioners' services is greater than the corresponding estimate for single females in 1963 and 1964. However, for 1965 and subsequent years this pattern is reversed with single females having the larger average expense.

The relationship between age and medical expense for general

²¹No statistical tests were performed to determine if these differences are statistically significant. See n. 16, p. 87.

TABLE 5.15
REGRESSION COEFFICIENTS, EXPENDITURES ON ALL GENERAL
PRACTITIONERS' SERVICES, BY YEAR

	1963	1964	1965	1966	1967
Intercept	21.26	23.81	30.95	27.94	39.70
Family Income	.00041 (0.00008)	.00031 (0.00008)	00.00* (0.00)	-.00014 (0.00008)	-.0002 (0.00007)
Direct Charge	2.52 (0.06)	2.40 (0.06)	2.65 (0.07)	2.42 (0.08)	2.02 (0.09)
Spouse Absent					
Single Male	-13.54 (0.81)	-14.29 (0.82)	-18.15 (0.87)	-17.84 (0.90)	-21.71 (0.91)
Single Female	-14.33 (0.80)	-15.26 (0.82)	-16.04 (0.88)	-13.16 (0.93)	-17.12 (0.93)
Children Present					
One	10.11 (0.92)	14.29 (0.95)	20.41 (1.03)	20.18 (1.07)	22.49 (1.11)
Two	11.83 (1.01)	12.16 (1.05)	11.45 (1.13)	10.50 (1.17)	7.17 (1.20)
Three	11.27 (1.16)	11.51 (1.20)	9.11 (1.29)	11.32 (1.33)	13.93 (1.38)
Four	13.60 (1.37)	12.54 (1.42)	9.84 (1.52)	14.80 (1.57)	12.87 (1.67)
Five Plus	18.73 (1.36)	19.22 (1.41)	23.58 (1.50)	19.37 (1.55)	15.76 (1.68)
Age of Family Head					
25-34	7.28 (0.99)	5.60 (1.01)	3.18 (1.12)	1.04 (1.16)	-9.25 (1.16)
35-44	4.02 (1.03)	1.51 (1.07)	-0.53 (1.18)	3.67 (1.22)	-4.10 (1.23)
45-54	4.79 (1.00)	3.32 (1.03)	0.56* (1.13)	4.88 (1.18)	-1.83* (1.16)
55-64	11.37 (1.02)	11.54 (1.04)	8.77 (1.13)	11.17 (1.16)	4.24 (1.15)
65-74	12.81 (1.10)	17.41 (1.12)	16.26 (1.21)	21.73 (1.24)	14.13 (1.24)
75 +	14.74 (1.14)	17.69 (1.12)	15.09 (1.20)	29.24 (1.21)	24.70 (1.20)
Urban	-8.93 (0.57)	-9.28 (0.58)	-9.89 (0.63)	-9.31 (0.65)	-10.30 (0.65)
R ²	0.20	0.20	0.20	0.19	0.17

*Not statistically significant at the 5% level.

practitioners' services appears nonlinear for the years 1963 to 1965, with the same decline in expenditure for those over 75 years of age as noted for expenditures on all services.

The negative sign and increasing absolute magnitude of the location variable indicates that utilization of general practitioner services is less per family for urban families and that the disparity is increasing. It will be recalled, of course, that the model assumes no interactions between the dummy variables. Thus, part of the larger expenditure of rural families may be due to larger families in such areas.

Similar equations were also fitted to the data for expenditure on all services provided by specialists. The estimated coefficients are presented in Table 5.16. The model seems to be less satisfactory since estimates of negative average expense are obtained for several family types. The linearity assumption was offered as a tentative explanation for such results in previous discussion.

The coefficients on the income variable are much larger in size for specialists' services than those obtained for general practitioners' services. The tendency for higher incomes to lead to greater use of specialists' services declines over time with the exception of a departure from the trend in 1964.

The point estimates of average expense are larger for single males than for single females for all of the years. Also the coefficients for the 75 plus years age class are always smaller than those for the previous age category.

The coefficients on the location variable indicate substantially larger average expenditure for specialists' services by urban

TABLE 5.16

REGRESSION COEFFICIENTS, EXPENDITURES
ON ALL SPECIALISTS' SERVICES, BY YEAR

	1963	1964	1965	1966	1967
Intercept	-1.70	-0.40	-0.08	1.29	7.41
Family Income	.00077 (0.00008)	.00107 (0.00008)	.00085 (0.00009)	.00060 (0.00009)	.00052 (0.00010)
Direct Charge	3.88 (0.06)	4.48 (0.07)	4.70 (0.08)	5.72 (0.09)	6.39 (0.12)
Spouse Absent					
Single Male	-5.00 (0.84)	-6.97 (0.91)	-7.56 (1.02)	-7.99 (1.07)	-11.74 (1.24)
Single Female	-8.90 (0.83)	-9.96 (0.90)	-10.10 (1.04)	-10.95 (1.10)	-12.86 (1.26)
Children Present					
One	4.05 (0.96)	4.65 (1.05)	8.91 (1.20)	7.74 (1.27)	7.63 (1.52)
Two	0.03 (1.05)	0.55 (1.16)	4.63 (1.32)	4.70 (1.40)	3.29 (1.63)
Three	2.92 (1.21)	2.97 (1.32)	1.85 (1.50)	2.63 (1.59)	9.24 (1.88)
Four	-1.56 (1.42)	4.60 (1.57)	-0.29 (1.78)	2.83 (1.87)	3.32 (2.27)
Five Plus	6.64 (1.41)	-0.52 (1.55)	1.94 (1.75)	-2.62 (1.84)	-1.97 (2.29)
Age of Family Head					
25-34	4.35 (1.02)	4.82 (1.11)	4.52 (1.30)	2.99 (1.37)	-2.54* (1.57)
35-44	7.81 (1.07)	8.74 (1.18)	7.82 (1.37)	8.64 (1.46)	6.69 (1.68)
45-54	9.13 (1.04)	9.80 (0.14)	10.38 (1.32)	10.18 (1.40)	8.26 (1.58)
55-64	13.38 (1.06)	12.88 (1.15)	14.80 (1.32)	17.75 (1.38)	13.14 (1.56)
65-74	16.37 (1.15)	17.76 (1.24)	21.17 (1.41)	23.10 (1.47)	18.95 (1.68)
75 +	9.02 (1.18)	12.19 (1.24)	13.53 (1.40)	16.99 (1.44)	13.88 (1.63)
Urban	16.18 (0.60)	18.44 (0.64)	20.69 (0.74)	20.95 (0.77)	22.21 (0.88)
R ²	0.14	0.15	0.13	0.14	0.12

*Not statistically significant at the 5% level.

families reflecting, no doubt, the availability of services in urban centres.

The Distribution of Medical Services

The regression coefficients from the equations that were fitted for the dummy variable models may be translated into point estimates of average utilization for each type of family. The regression model assumes that the coefficients are additive. Thus, as stated above, the coefficients for single males may be added to the intercept, or base estimate, to get a point estimate of average expense for single males. Table 5.17 presents such estimates for the 1967 regression equation from Table 5.3. The income, direct charge, and location variable have been excluded from the equation.

Location was excluded to simplify the statistical presentation. As a result, therefore, estimates are presented for families regardless of location rather than separate estimates for rural families and for urban families. Income and direct charge are excluded because they are continuous variables. The calculations of point estimates of average expenditure when based upon the dummy variables alone have a straightforward interpretation. That is, a statement can be made about the expected expenditure of identifiable socio-demographic classes of families. If the continuous variables are included, the point estimates of average expenditure assume constant income and constant direct charge. They do not correspond to an identifiable population group. An additional reason for excluding these variables is that the equations correspond to those used in another study.²²

²²See p. 76.

The point estimates of average expense are of interest because they show the distributional aspects of choosing a uniform premium. In addition, a check on the estimates may be made by combining the data in Table 4.2 and the data in Table 5.17. If the number of families in each class is multiplied by the point estimate of average expense for that class and the resultant amount cumulated, an estimate of total cost can be obtained. The total cost so obtained is \$2.6 million compared with the total cost for 1967 of \$2.8 million from Table 3.2. If population distributions similar to Table 4.2 were available a comparison could have been made with the total cost of the medical care scheme in that year.

The ability to derive point estimates from the model will be drawn on again in Chapter Six which considers the effects of the introduction of utilization fees on family medical expenditures.

CHAPTER VI

THE EFFECTS OF THE UTILIZATION FEES

The Medical Care Insurance Plan has been in continuous operation in Saskatchewan since July 1, 1962. The analysis in the previous chapter focused on the years 1963 through 1967. The last six months of 1962 were excluded from consideration because of the unusual circumstances associated with the introduction of the plan, while in 1968 a number of structural changes took place. First, a utilization fee on visit items was introduced. Second, the schedule of fees was increased, actually in two steps. Thus, an analysis of 1968 expenditures requires separate consideration.

The purposes of this chapter are: (a) to analyze the effects of utilization fees on the total cost of the medical care program; (b) to analyze the effects of the utilization fees on medical expenditure by various family classes; and (c) to examine the differential impact of utilization fees among the components of medical services.

The Effects on Total Cost of the Plan

In order to assess the effects of the utilization fees on total costs of the medical care plan, it is necessary to predict what total costs would have been in the absence of such fees. In addition, it is difficult to account for the effects of the increase in the schedule of fees. Predicting medical care costs in the absence of

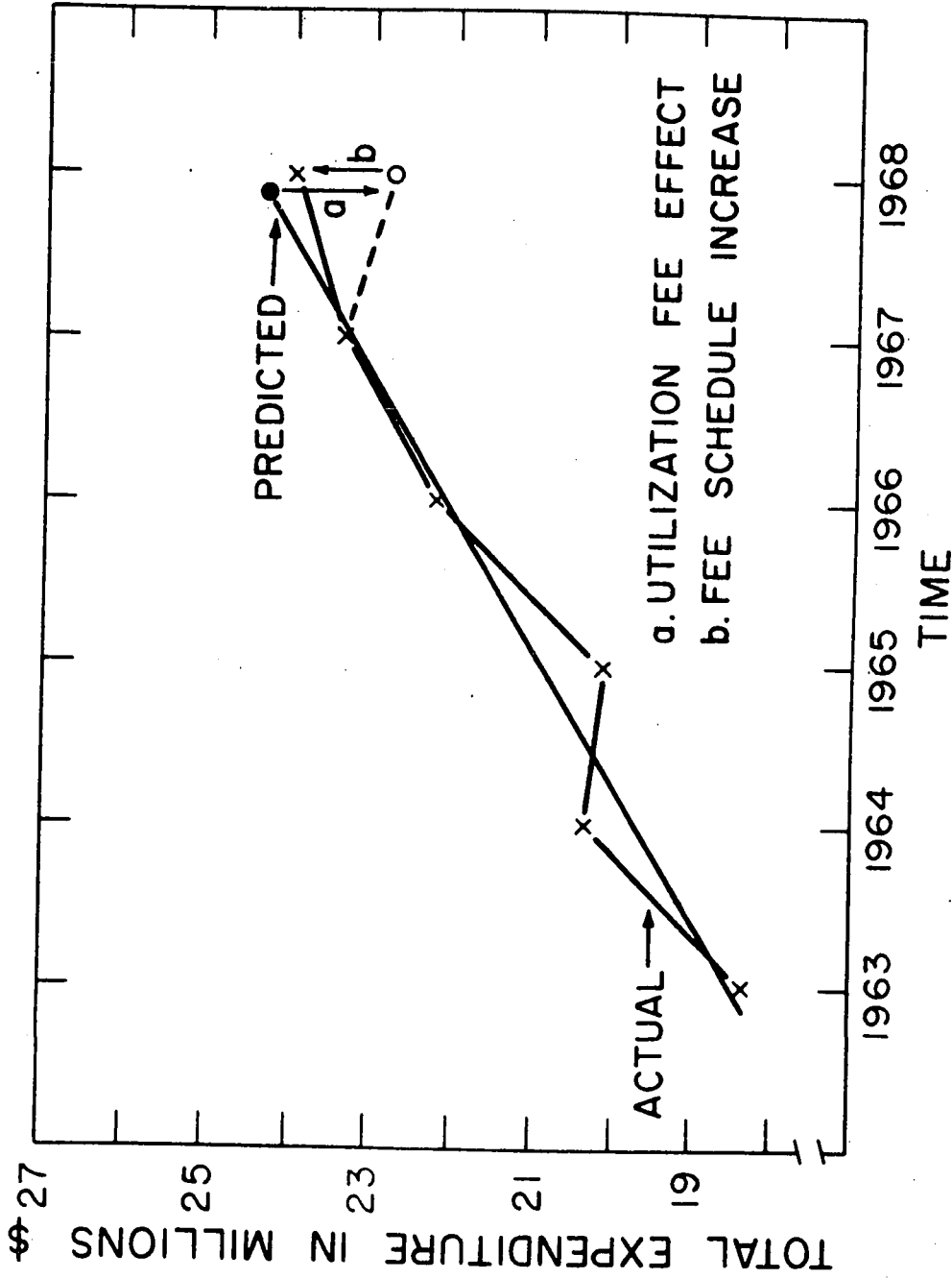
utilization fees is hazardous because of the brevity of the historical experience. With only five full years of experience extrapolation of costs may involve large errors in the predictions. Nevertheless, such predictions must be made if the effects of utilization fees are to be assessed.

The total costs of the Medical Care Insurance Plan increased in current dollars from \$18.27 million in 1963 to \$23.38 million in 1967.¹ This represents an average annual growth rate of 4.8 per cent. Figure 6.1 shows the behaviour of total costs over the period. A linear regression equation fitted to the five observations on expenditure and time is included in the figure. The extrapolated estimate of medical care cost for 1968 is \$24.49 million. This prediction, however, cannot be compared directly with the actual level of expenditure for 1968 since that figure includes the effects of a price increase through a change in the fee schedule.

A crude estimate of 1968 expenditures minus the effects of the fee increase may be obtained by costing 1968 services at the average cost per service for 1967 services. The number of services in 1968 was 4,804,000 and the average payment per service in 1967 was \$4.75, yielding an estimated cost of \$22.819 million for 1968.² Thus, the effect of the utilization fee, using this estimate, was to reduce expenditure from an estimated \$24.486 million to \$22.819 million, or by about 6.8 per cent in 1968. Of this \$1.667 million reduction in

¹ Medical Care Insurance Commission, Annual Reports, 1963 and 1967 (Regina: Queen's Printer).

² Medical Care Insurance Commission, Annual Report 1968 (Regina: Queen's Printer, 1968), pp. 40 and 42.



SOURCE : MEDICAL CARE INSURANCE COMMISSION ANNUAL REPORTS

FIGURE 6.1 TOTAL EXPENDITURE ON MEDICAL CARE SERVICES

cost, over one half, or \$1.254 million, was lost by increasing the level of the fee schedule.

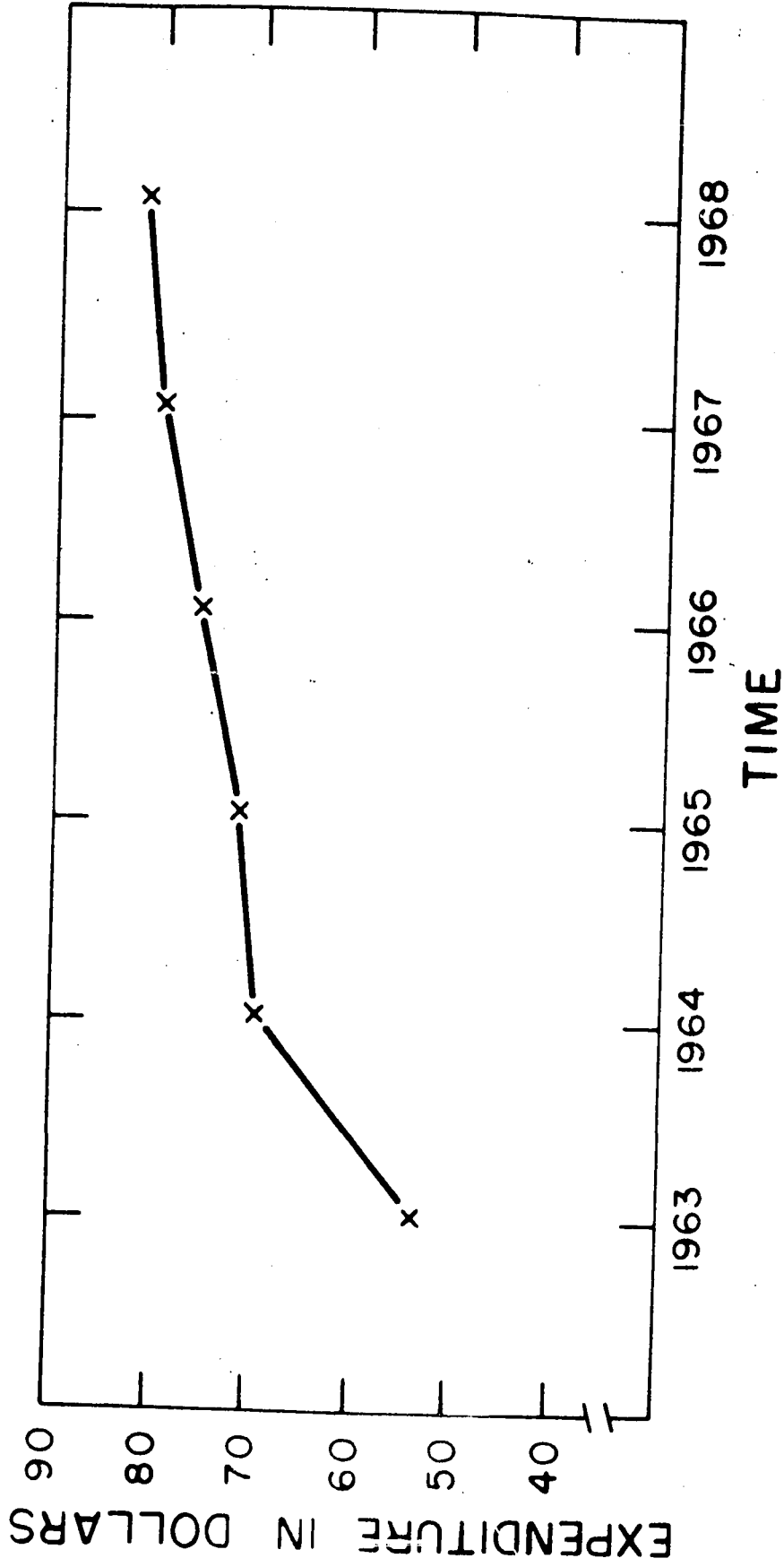
The above analysis is over-simplified because it does not take into account population changes. In Chapter Two, it was argued that the appropriate decision-making unit is the family. If so, population changes may be accounted for by expressing costs in per family terms. Figure 6.2 shows average payment per family receiving benefits for the years since 1963. Comparing 1967 and 1968, the utilization fee appears to have had little effect. This may be due to the change in prices.

A more vivid picture of the effects of utilization fees may be obtained by expressing family utilization in quantity terms. Figure 6.3 shows the average number of services per family receiving benefits for the years 1963 through 1968. A logistic growth curve was fitted by the method of selected points to the 1963 through 1967 observations. The equation has the following form:

$$Y_i = \frac{k}{10^a + bX_i}$$

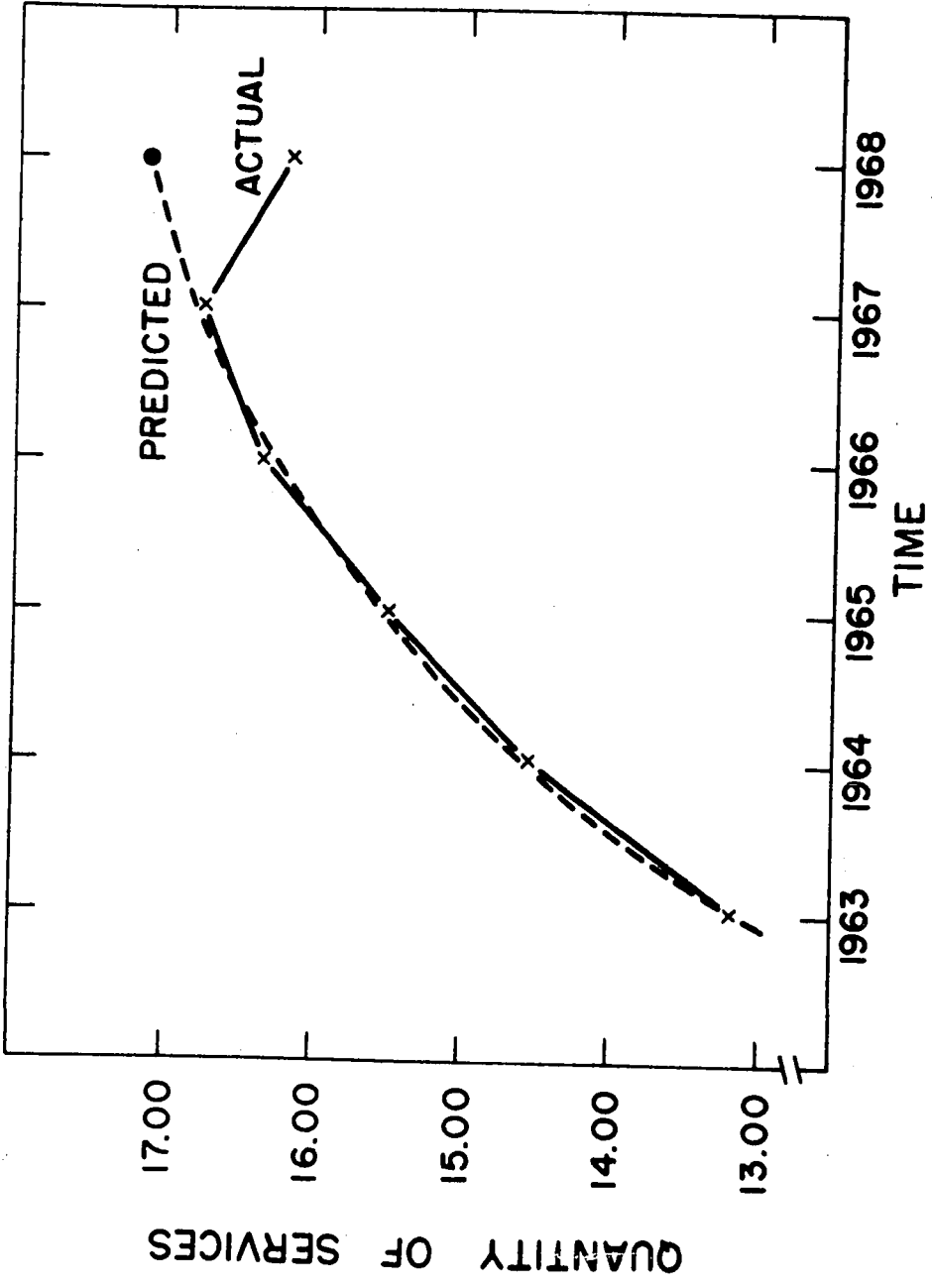
where Y_i is the quantity of services per family receiving benefits and X_i is time. Upon examination, an equation of this form fits the data extremely well. Extrapolating the curve to 1968 yields an estimate of 17.15 services per family in the absence of utilization fees, compared with the actual value of 16.19 in 1968. This represents about a 6 per cent decline in overall utilization which may be a result of the utilization fee.

In summary, the overall effect of utilization fees in 1968 would appear to be that they reduced utilization by between 6 per cent and 7



SOURCE : MEDICAL CARE INSURANCE COMMISSION ANNUAL REPORTS

FIGURE 6.2. AVERAGE PAYMENT PER FAMILY RECEIVING BENEFITS



SOURCE MEDICAL CARE INSURANCE
COMMISSION ANNUAL REPORTS

FIGURE 6.3 AVERAGE NUMBER OF SERVICES PER FAMILY RECEIVING BENEFITS

per cent depending on whether the quantity of services per family or the total expenditure at 1967 average costs estimate is used. Estimates in dollar terms are clearly understatements. The above estimates indicate the range of the overall effect or average effect of the utilization fees.

The Effects of Utilization Fees on Selected Family Classes

The impact of utilization fees may vary by type and size of families. Indeed, the crucial issue in evaluating the effects of such fees is the relative magnitude of this effect on various classes of families. An evaluation of these effects requires some method for predicting what expenditures or utilization by various categories of families would have been in the absence of such a policy.

The model developed in Chapter Four may be used to get point estimates of average expenditure by year for several categories of families. Table 6.1 presents estimated coefficients for the equations fitted to the annual cross section data on family medical expenditure and the set of dummy variables that define family categories. As noted above, point estimates of average expenditure can be obtained for a given family category by summing the coefficients of the appropriate dummy variables. Thus, for example, the point estimate of average expenditure for a couple with family head aged 35-44 and two children is \$30.14 plus \$16.73 plus \$13.83 plus \$13.42, or \$74.12 for 1963. Similarly, all the permutations of the dummy variables may be evaluated to get estimates for other family classes. Table 6.2 contains a complete set of such estimates for 1968. A similar set of estimates could be computed for 1967 for comparative purposes to show the

TABLE 6.1

REGRESSION COEFFICIENTS AND STANDARD ERRORS, FAMILY
EXPENDITURE AND FAMILY DUMMY VARIABLES, BY YEAR

	1963	1964	1965	1966	1967	1968
Intercept	30.14	36.44	42.88	40.62	58.67	65.04
Spouse Absent						
Single Male	-22.17 (1.30)	-25.89 (1.38)	-29.41 (1.49)	-26.36 (1.55)	-37.05 (1.68)	-41.62 (1.77)
Single Female	-27.22 (1.28)	-30.49 (1.35)	-28.76 (1.51)	-29.62 (1.59)	-31.52 (1.70)	-31.27 (1.78)
Children Present						
One	16.73 (1.50)	21.29 (1.62)	32.51 (1.77)	30.19 (1.87)	31.93 (2.09)	29.24 (2.19)
Two	13.83 (1.65)	15.39 (1.78)	16.00 (1.94)	17.00 (2.05)	10.52 (2.25)	11.36 (2.34)
Three	16.46 (1.88)	14.94 (2.03)	12.13 (2.22)	14.78 (2.33)	25.54 (2.59)	16.93 (2.72)
Four	10.63 (2.23)	17.41 (2.40)	8.81 (2.62)	17.20 (2.75)	14.71 (3.13)	10.38 (3.27)
Five Plus	27.85 (2.21)	18.88 (2.38)	28.93 (2.58)	16.41 (2.70)	13.09 (3.16)	25.99* (3.34)
Age of Family Head						
25-34	13.94 (1.61)	12.24 (1.71)	9.22 (1.93)	4.07 (2.02)	-12.65 (2.17)	-7.96 (2.23)
35-44	13.42 (1.67)	11.88 (1.80)	8.56 (2.02)	12.82 (2.13)	2.41 (2.30)	4.12 (2.40)
45-54	15.14 (1.61)	15.06 (1.74)	11.77 (1.94)	14.68 (2.05)	5.30 (2.16)	7.11 (2.24)
55-64	21.15 (1.65)	26.04 (1.75)	23.82 (1.94)	28.51 (2.02)	16.78 (2.15)	14.10 (2.23)
65-74	31.97 (1.80)	37.43 (1.90)	38.24 (2.08)	45.68 (2.16)	32.46 (2.32)	31.88 (2.41)
75 +	26.05 (1.85)	32.54 (1.90)	29.45 (2.06)	46.87 (2.11)	39.91 (2.25)	43.59 (2.34)
R ²	.12	.12	.13	.13	.11	.10

*Significantly different at the 5% level from the 1963-1967 structures.
See p. 122.

TABLE 6.2

POINT ESTIMATES OF AVERAGE EXPENDITURE BY FAMILY CLASS, 1968

	Age of Family Head						
	18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples							
0 children	65.04	57.08	69.17	72.15	79.14	96.93	108.63
1 child	94.28	86.32	98.40	101.39	108.38	126.16	137.87
2 children	105.64	97.67	109.76	112.75	119.74	137.52	149.22
3 children	122.57	114.60	126.70	129.68	136.68	154.46	166.16
4 children	132.95	124.99	137.08	140.07	147.06	164.84	176.54
5+ children	158.94	150.98	163.07	166.06	173.05	190.83	202.53
Single Male							
0 children	23.42	15.45	27.54	30.53	37.52	55.30	67.00
1 child	52.66	44.69	56.78	59.77	66.76	84.54	96.24
2 children	64.01	56.05	68.14	71.13	78.12	95.90	107.60
3 children	80.95	72.98	85.07	88.06	95.05	112.83	124.54
4 children	91.33	83.37	95.46	98.45	105.44	123.22	134.92
5+ children	117.32	109.36	121.45	124.44	131.43	149.21	160.91
Single Female							
0 children	33.77	25.80	37.89	40.88	47.87	65.65	77.36
1 child	63.01	55.04	67.13	70.12	77.11	94.89	106.59
2 children	74.37	66.40	78.49	81.48	88.47	106.25	117.95
3 children	91.30	83.33	95.42	98.41	105.40	123.18	134.88
4 children	101.68	93.72	105.81	108.80	115.79	133.57	145.27
5+ children	127.67	119.71	131.80	134.79	141.78	159.56	171.26

effects of the utilization fee. Such a comparison, however, does not take account of the effect of time on family utilization of medical services and would, therefore, understate the case.³ Actual 1968 expenditure estimates must be compared with expected expenditure in the absence of utilization fees.

The procedure for predicting family average expenditure in 1968, assuming no utilization fees, is as follows. Each of the row coefficients in Table 6.1 has a sampling distribution since, over time, a given coefficient, such as the coefficient for couples (or intercept), is a random variable. This random variable may be regressed on time by fitting an equation of the form

$$C_i = a + b T_i + u_i$$

where C_i is a coefficient (in this example the intercept) on which there are $i = 1, 5$ observations; T_i is time, and u_i is an error term. Table 6.3 shows the equations fitted to each of the coefficients from Table 6.1. These equations may be used to predict the value of the coefficient for 1968. The predicted values of the dependent variable for 1968 are also shown in Table 6.3. The sign and magnitude of the regression slopes in column two shows the direction and amount of change in a given coefficient over time. Thus, for example, the age coefficients decline over time for younger age groups and increase by small amounts for the two oldest age categories. The entries in column four are the predicted values of the coefficients for 1968.

³Nor, of course, does it take account of changes in family income. However, as noted above the marginal propensity to consume medical services is small. In addition, changes in average family income are not very large. See Table A.6 in Appendix A.

TABLE 6.3
 PREDICTION EQUATIONS, FAMILY EXPENDITURE FOR 1968^a

	Intercept	Slope	R ²	\hat{Y}	Standard Error
Intercept	23.38 (4.41)	6.12 (3.83)	0.77	60.12	5.06
Spouse Absent					
Single Male	-19.10 (-5.45)	-3.02 (-2.86)	0.64	-37.25	3.34
Single Female	-27.20 (-20.41)	-0.77* (-1.92)	0.40	-31.84	1.27
Children Present ^b					
One	14.74 (3.54)	3.93 (3.13)	0.69	38.32	3.97
Two	30.79 (5.00)	3.43* (-0.57)	0.10**	13.04	2.77
Three	11.37 (2.19)	1.80* (1.15)	.07	22.17	4.95
Four	53.53 (3.09)	6.02* (0.59)	0.10**	16.14	4.24
Five Plus	30.63 (5.17)	-3.19* (-1.79)	.36	11.44	5.64
Age of Family Head					
25-34	23.76 (4.25)	-6.13 (-3.63)	0.75	-13.04	5.34
35-44	16.14 (4.31)	-2.11* (-1.87)	0.38	3.50	3.57
45-54	18.41 (5.52)	-2.00* (-1.99)	0.43	6.38	3.18
55-64	25.14 (4.35)	-0.63* (-0.39)	0.05**	21.38	5.10
65-74	34.38 (5.74)	0.92* (0.47)	0.07**	39.93	6.17
75 +	22.35 (3.60)	4.20* (2.25)	.50	47.55	5.92

^aThe t statistics are in brackets below the coefficients.

^bThe \hat{Y} are presented as first differences here for compatibility.
 See p. 65.

* Not statistically significant at $\alpha = .10$.

** Unadjusted R².

Statistical tests have been performed to determine if the observation for 1968 belongs to the same linear structure as the 1963 to 1967 observations.⁴ The procedure is equivalent to asking whether the observed 1968 value is within about two standard errors of the predicted value. The observed values for 1968 that are statistically significant at the 5 per cent level are noted in Table 6.1 and all subsequent similar tables.

Many of the observations are not statistically significant but this is expected. A priori the 1968 observed values are expected to be smaller than the predicted 1968 values as indeed they are in most cases. However, the amount of this difference is not so strong as hoped for. The problem is, of course, that with only five observations, very large deviations are necessary to be statistically significant. In the case of couples, for example, the deviation would have to be large enough to imply reductions in expenditure in excess of 20 per cent in order to be statistically significant. Deviations of lesser magnitude are obviously economically significant although not statistically significant. As the Wonnacotts point out, "We therefore must distinguish between statistical significance, and practical importance."⁵

As a check against the reliability of the predicted coefficients in Table 6.3, an alternative procedure for obtaining predictions for 1968, assuming no utilization fee, was tried. The procedure was to

⁴ See J. Johnston, Econometric Methods (N.Y. and Toronto: McGraw-Hill Book Co., Inc., 1963), p. 37.

⁵ T. H. Wonnacott and R. J. Wonnacott, Introductory Statistics (N.Y. and Toronto: John Wiley & Sons, Inc., 1969), p. 179, n. 3.

estimate the coefficients using the experience of families in the first three and one half months of that year; the period prior to April 15th. An equation of a form similar to those fitted to the annual data and presented in Table 6.1, was estimated using data on family medical expenditures in 1968 prior to the introduction of utilization fees. The coefficients from this equation were then weighted by a sufficient proportion to make the time period equivalent to one year. That is, since the period covers only three and one half months the coefficients were multiplied by 3.47. These coefficients are presented in Table 6.4 together with the coefficients obtained using the sets of annual data. In comparing the two sets of predicted coefficients it must be noted that the estimates using the data for the period prior to April 15th do contain some effects of a price change. The rate of payment under the old fee schedule was increased from 85 per cent to 95 per cent for home and office visits as of November 1, 1967. In addition, there are seasonal factors involved. The first quarter of the year usually accounts for about 26 per cent of total services.⁶ On the whole, the differences between the two methods of estimation are sufficiently small as to lend credibility to the estimates. In subsequent analysis the first method of estimation will be used.

The predicted coefficients in Table 6.3 may be evaluated to get point estimates of average utilization by type of family for comparison with similar estimates provided in Table 6.2. A complete set of such estimates for all permutations of the dummy variables which describe family characteristics is presented in Table 6.5.

⁶Research Branch, Medical Care Insurance Commission.

TABLE 6.4
 COMPARISON OF TWO METHODS OF PREDICTING
 1968 FAMILY EXPENDITURE

	$3\frac{1}{2}$ Months Weighted by 3.47	Projected Using Time
Intercept	60.86	60.12
Spouse Absent		
Single Male	-40.92	-37.25
Single Female	-34.44	-31.84
Children Present		
One	38.87	38.32
Two	7.17	13.04
Three	19.32	22.17
Four	13.44	16.14
Five Plus	30.56	11.44
Age of Family Head		
25-34	-7.44	-13.04
35-44	9.29	3.50
45-54	11.76	6.38
55-64	24.13	21.38
65-74	40.30	39.93
75 +	45.10	45.98

TABLE 6.5
 PREDICTED FAMILY EXPENSE, 1968 ASSUMING NO UTILIZATION FEE

	Age of Family Head						
	18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples							
0 children	60.12	47.08	63.61	66.50	81.50	100.05	107.67
1 child	98.44	85.40	101.93	104.82	119.82	138.37	145.99
2 children	111.48	98.44	114.97	117.86	132.86	151.41	159.03
3 children	133.65	120.61	137.14	140.03	155.03	173.58	181.20
4 children	149.79	136.75	153.28	156.16	171.17	189.72	197.33
5+ children	161.23	148.19	164.72	167.60	182.61	201.16	208.77
Single Male							
0 children	22.87	9.83	26.36	29.25	44.25	62.80	70.42
1 child	61.19	48.15	64.68	67.57	82.57	101.12	108.74
2 children	74.23	61.19	77.72	80.61	95.61	114.16	121.78
3 children	96.40	83.36	99.89	102.78	117.78	136.33	143.95
4 children	112.54	99.50	116.03	118.92	133.92	152.47	160.08
5+ children	123.98	110.94	127.47	130.36	145.36	163.91	171.52
Single Female							
0 children	28.28	15.24	31.77	34.66	49.66	68.21	75.82
1 child	66.60	53.56	70.09	72.98	87.98	106.53	114.15
2 children	79.64	66.60	83.13	86.02	101.02	119.57	127.19
3 children	101.81	88.77	105.30	108.19	123.19	141.74	149.36
4 children	117.95	104.91	121.44	124.32	139.33	157.88	165.49
5+ children	129.39	116.35	132.88	135.76	150.77	169.32	176.93

Estimates of the effects of the utilization fee by type of family can now be obtained by comparing Tables 6.2 and 6.5. The latter table contains predictions of average family expense in 1968 assuming no utilization fees. The former contains estimates of actual average expense by family for 1968. Estimates of the effect of utilization fees on average expenditure for the various categories of families are presented in Table 6.6. The figures in this table show the percentage change in actual 1968 average expense per family over average expense per family predicted on the assumption of no utilization fees. Thus, the entry in the table for couples with head aged 18-24 years and no children indicates that actual expenditure in 1968 was 8.2 per cent greater than predicted expenditure. The utilization fee apparently has no restraining effect on such families. On the other hand, the entry for couples with head aged 55-64 years and four children indicates a 14.1 per cent decline in expenditure as a result of the utilization fee. In general, the data in the table suggests that the deterrent effect of the utilization fee is greater the larger the family and the older the head of the family. An exception to this is the case of families with five or more children. It is not readily apparent why the effects should be relatively lower for this category.

A difficulty with the above analysis of the effects of utilization fees on various classes of families is that again the estimates are in dollar terms. The data for 1968, upon which the point estimates of actual average expense were based, contains the effects of a revision in the fee schedule and again an adjustment must be made. To eliminate this effect the equations presented in Table 6.1 were re-estimated using quantity of services as the dependent variable and the same set

TABLE 6.6

PER CENT CHANGE IN FAMILY MEDICAL EXPENSE AFTER UTILIZATION FEES

	Age of Family Head						
	18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples							
0 children	+ 8.16	+21.23	+ 8.74	+ 8.51	- 2.89	- 3.12	+ 0.89
1 child	- 4.23	+ 1.07	- 3.46	- 3.27	- 9.55	- 8.82	- 5.56
2 children	- 5.24	- 0.78	- 4.53	- 4.33	- 9.88	- 9.17	- 6.17
3 children	- 8.29	- 4.98	- 7.62	- 7.39	-11.84	-11.02	- 8.30
4 children	-11.24	- 8.60	-10.57	-10.31	-14.08	-13.11	-10.54
5+ children	- 1.42	+ 1.88	- 1.00	- 0.92	- 5.24	- 5.13	- 2.99
Single Male							
0 children	+ 2.40	+57.19	+ 4.49	+ 4.39	-15.20	-11.93	- 4.85
1 child	-13.95	- 7.19	-12.21	-11.54	-19.15	-16.39	-11.49
2 children	-13.76	- 8.40	-12.33	-11.76	-18.30	-15.99	-11.64
3 children	-16.03	-12.45	-14.83	-14.32	-19.30	-17.24	-13.49
4 children	-18.84	-16.21	-17.73	-17.21	-21.27	-19.18	-15.72
5+ children	- 5.37	- 1.42	- 4.72	- 4.54	- 9.58	- 8.97	- 6.19
Single Female							
0 children	+19.42	+69.32	+19.28	+17.96	- 3.60	- 3.74	+ 2.02
1 child	- 5.39	+ 2.77	- 4.22	- 3.92	-12.35	-10.92	- 6.62
2 children	- 6.62	- 0.30	- 5.58	- 5.28	-12.42	-11.14	- 7.26
3 children	-10.32	- 6.12	- 9.38	- 9.04	-14.44	-13.09	- 9.69
4 children	-13.79	-10.67	-12.87	-12.49	-16.90	-15.40	-12.22
5+ children	- 1.32	+ 2.89	- 0.81	- 0.72	- 5.96	- 5.76	- 3.21

of dummy variables describing family characteristics as independent variables. The resulting estimates are presented in Table 6.7. Similar extrapolation procedures based on regression of the coefficients on time were applied to get predicted quantity of services per family for 1968. Table 6.8 contains the separate regression equations for each of the coefficients from the cross section equations. Table 6.9 shows the point estimates of actual quantity of services per family for 1968 which are derived from the 1968 regression equation in Table 6.3. The corresponding point estimates of quantity of services per family that are predicted for 1968 in the absence of utilization fees are presented in Table 6.10. The effects of utilization fees on various categories of families are shown in Table 6.11.

The differences between the effects shown in Table 6.6 and Table 6.11 illustrates the amount by which estimates in dollar terms understate the impact of utilization fees. The tendency for the impact to be felt more by larger families and older families is again evident. The fact that this effect is carried over into families with five or more children suggests that some of the reduction noted above for dollar estimates, may be due to price changes on the particular bundle of services taken by such families. Even in quantity terms, however, the magnitude of the effects for the families with five or more children is surprisingly lower than the effect for smaller families. The above argument may also hold in the case of families with a head aged 75 years or more. The percentage reductions in dollar terms are small whereas in quantity terms they are closer to the 65-74 age class. Both of these situations may be a result of the inability to specify interactions effects in the model. That is, if

TABLE 6.7
REGRESSION COEFFICIENTS AND STANDARD ERRORS,
QUANTITY OF SERVICES PER FAMILY AND FAMILY,
DUMMY VARIABLES, BY YEAR

	1963	1964	1965	1966	1967	1968
Intercept	4.38	5.70	7.08	6.66	9.65	9.80
Spouse Absent						
Single Male	-3.13 (0.22)	-4.04 (0.25)	-4.96 (0.26)	-4.81 (0.28)	-5.96 (0.29)	-6.38 (0.28)
Single Female	-3.93 (0.21)	-4.83 (0.24)	-4.69 (0.26)	-4.05 (0.28)	-5.06 (0.29)	-4.54 (0.28)
Children Present						
One	2.71 (0.25)	3.77 (0.29)	5.07 (0.31)	5.25 (0.33)	5.15 (0.36)	4.33 (0.35)
Two	2.03 (0.28)	2.16 (0.32)	2.31 (0.34)	2.54 (0.36)	2.57 (0.39)	2.70 (0.37)
Three	2.20 (0.32)	2.78 (0.36)	2.56 (0.39)	2.79 (0.41)	3.28 (0.45)	1.79 (0.43)
Four	1.92 (0.37)	1.74 (0.43)	1.54 (0.46)	2.60 (0.49)	2.42 (0.54)	1.97 (0.52)
Five Plus	3.44 (0.37)	3.03 (0.42)	3.95 (0.45)	2.88 (0.48)	3.18 (0.55)	3.68 (0.53)
Age of Family Head						
25-34	2.04 (0.27)	1.55 (0.30)	1.28 (0.34)	0.69 (0.36)	-2.00 (0.38)	-1.55 (0.35)
35-44	2.95 (0.28)	2.31 (0.32)	1.81 (0.35)	2.49 (0.38)	0.80 (0.40)	0.86 (0.38)
45-54	3.14 (0.27)	3.06 (0.31)	2.52 (0.34)	2.98 (0.36)	1.51 (0.37)	1.39 (0.36)
55-64	5.53 (0.28)	5.45 (0.31)	5.11 (0.34)	5.43 (0.36)	3.89 (0.37)	3.23 (0.35)
65-74	6.62 (0.30)	8.46 (0.34)	8.32 (0.36)	9.94 (0.38)	8.11 (0.40)	7.61 (0.38)
75 +	7.46 (0.31)	8.72 (0.34)	8.56 (0.36)	13.38 (0.38)	11.93 (0.39)	12.12 (0.37)

Coefficients are presented in marginal form. See p. 65.

TABLE 6.8
 PREDICTION EQUATIONS, QUANTITY OF SERVICES
 PER FAMILY FOR 1968^a

	Intercept	Slope	R ²	\hat{Y}	Standard Error
Intercept	3.25 (3.78)	1.15 (4.45)	0.82	10.14	0.82
Spouse Absent					
Single Male	-2.65 (-7.28)	-0.64 (-5.86)	0.89	-6.50	0.35
Single Female	-4.07 (-7.67)	-0.15* (-0.93)	0.22**	-4.75	0.51
Children Present ⁺					
One	2.48 (4.22)	0.64 (3.59)	0.75	6.30	0.56
Two	1.88 (35.88)	.14 (9.22)	.96	2.75	0.05
Three	2.07 (8.92)	.21 (3.10)	.68	3.39	0.22
Four	1.49 (3.59)	1.18* (1.49)	0.23	2.59	0.39
Five Plus	3.50 (7.10)	-0.07* (-0.45)	0.06**	3.10	0.47
Age of Family Head					
25-34	3.40 (3.82)	-0.90 (-3.34)	.72	-1.97	.85
35-44	3.31 (5.49)	-0.41* (-2.27)	.51	0.83	.57
45-54	3.64 (7.10)	-0.33* (-2.16)	.48	1.64	.49
55-64	6.07 (11.28)	-0.33* (-2.03)	.44	4.09	.51
65-74	6.95 (6.06)	0.45* (1.29)	.14	9.63	1.09
75 +	5.93 (3.75)	1.36 (2.85)	.64	14.09	1.51

^aThe t statistics are in brackets below the coefficients.

⁺The \hat{Y} are presented as first differences here for compatibility. See p. 65.

* Not statistically significant at the 10% level.

**Unadjusted.

TABLE 6.9

POINT ESTIMATES OF QUANTITY OF SERVICES PER FAMILY, 1968

	Age of Family Head						
	18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples							
0 children	9.8	8.2	10.7	11.2	13.0	17.4	21.9
1 child	14.1	12.6	15.0	15.5	17.4	21.7	26.2
2 children	16.8	15.3	17.7	18.2	20.1	24.4	29.0
3 children	18.6	17.1	19.5	20.0	21.9	26.2	30.7
4 children	20.6	19.0	21.5	22.0	23.8	28.2	32.7
5+ children	24.3	22.7	25.1	25.7	27.5	31.9	36.4
Single Male							
0 children	3.4	1.9	4.3	4.8	6.6	11.0	15.5
1 child	7.7	6.2	8.6	9.1	11.0	15.4	19.9
2 children	10.4	8.9	11.3	11.8	13.7	18.0	22.6
3 children	12.2	10.7	13.1	13.6	15.5	19.8	24.4
4 children	14.2	12.6	15.1	15.6	17.4	21.8	26.3
5+ children	17.9	16.3	18.8	19.3	21.1	25.5	30.0
Single Female							
0 children	5.2	3.7	6.1	6.6	8.5	12.9	17.4
1 child	9.6	8.0	10.4	11.0	12.8	17.2	21.7
2 children	12.3	10.7	13.2	13.7	15.5	19.9	24.4
3 children	14.1	12.5	14.9	15.5	17.3	21.7	26.2
4 children	16.0	14.5	16.9	17.4	19.3	23.7	28.2
5+ children	19.7	18.2	20.6	21.1	23.0	27.3	31.8

TABLE 6.10

PREDICTED QUANTITY OF SERVICES PER FAMILY, 1968 ASSUMING NO UTILIZATION FEE

		Age of Family Head						
		18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples								
0 children		10.1	8.2	11.0	11.8	14.2	19.8	24.2
1 child		16.4	14.5	17.3	18.1	20.5	26.1	30.5
2 children		19.2	17.2	20.0	20.8	23.3	28.8	33.3
3 children		22.6	20.6	23.4	24.2	26.7	32.2	36.7
4 children		25.2	23.2	26.0	26.8	29.3	34.8	39.3
5+ children		28.3	26.3	29.1	29.9	32.4	37.9	42.4
Single Male								
0 children		3.6	1.7	4.5	5.3	7.7	13.3	17.7
1 child		9.9	8.0	10.8	11.6	14.0	19.6	24.0
2 children		12.7	10.7	13.5	14.3	16.8	22.3	26.8
3 children		16.1	14.1	16.9	17.7	20.2	25.7	30.2
4 children		18.7	16.7	19.5	20.3	22.8	28.3	32.8
5+ children		21.8	19.8	22.6	23.4	25.9	31.4	35.8
Single Female								
0 children		5.2	3.2	6.0	6.8	9.3	14.8	19.3
1 child		11.5	9.5	12.3	13.1	15.6	21.1	25.6
2 children		14.2	12.3	15.1	15.9	18.3	23.9	28.3
3 children		17.6	15.6	18.5	19.3	21.7	27.2	31.7
4 children		20.2	18.2	21.0	21.9	24.3	29.8	34.3
5+ children		23.3	21.3	24.2	25.0	27.4	32.9	37.4

TABLE 6.11
PER CENT CHANGE IN QUANTITY OF SERVICES FOR FAMILY AFTER UTILIZATION FEES

	Age of Family Head						
	18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples							
0 children	- 3.38	+ .93	- 2.84	- 5.06	- 8.42	-11.94	- 9.54
1 child	-14.08	-13.11	-13.22	-14.21	-15.44	-16.62	-14.03
2 children	-12.34	-11.32	-11.67	-12.58	-13.85	-15.22	-13.03
3 children	-17.53	-17.17	-16.77	-17.39	-18.05	-18.55	-16.16
4 children	-18.20	-17.94	-17.50	-18.03	-18.58	-18.96	-16.68
5+ children	-14.12	-13.59	-13.61	-14.19	-14.98	-15.86	-14.07
Single Male							
0 children	- 6.16	+11.72	- 4.30	- 9.04	-13.97	-16.90	-12.36
1 child	-22.10	-22.31	-20.10	-21.16	-21.76	-21.54	-17.33
2 children	-17.72	-17.08	-16.40	-17.46	-18.50	-19.12	-15.75
3 children	-23.88	-24.25	-22.51	-23.10	-23.28	-22.78	-19.25
4 children	-23.90	-24.22	-22.72	-23.22	-23.37	-22.90	-19.63
5+ children	-17.79	-17.45	-17.00	-17.63	-18.29	-18.76	-16.29
Single Female							
0 children	+ 1.28	+15.09	+ 1.62	- 2.74	- 8.51	-13.17	- 9.86
1 child	-16.59	-15.63	-15.21	-16.45	-17.73	-18.58	-15.15
2 children	-13.76	-12.56	-12.79	-13.93	-15.36	-16.66	-13.86
3 children	-20.13	-19.99	-19.05	-19.73	-20.28	-20.42	-17.39
4 children	-20.64	-20.57	-19.67	-20.25	-20.68	-20.74	-17.90
5+ children	-15.37	-14.82	-14.70	-15.37	-16.20	-17.00	-14.84

the large families and those in age category 75 years or more are situated in rural areas this could explain the above results.

In summary, while the overall effect of the utilization fee resulted in a modest 6 to 7 per cent decline in the utilization of services the impact was differentially distributed among classes of families. These effects ranged from a low of virtually no effect to a high of reductions in excess of 24 per cent.

The Effects on Families by Type of Service

Utilization fees were not imposed on all services performed by physicians. Rather such fees were imposed on visit items and procedures done in offices or out-patient departments: specifically, home and office visits and emergency and hospital out-patient visits. Consequently it should be possible to observe differential effects of the utilization fee between types of services that are predominantly visit items and other services less closely linked with visits.

The service categories used in this study are derived from the "major purpose groups" used by the Medical Care Commission. Those groups are listed in Chapter Three.⁷ The categories considered here are: complete examinations, regional examinations, home and emergency visits, hospital visits, laboratory services, major surgery, and minor surgery. The first three categories comprise the services for which utilization fees are applicable, although utilization fees are also common for minor surgical procedures.⁸

⁷See p. 55.

⁸This refers to utilization fees on physicians' services, as distinct from utilization fees for hospital stays which are part of the Hospital Services Plan.

The method of analysis is the same as used above for quantity of services by type of family. That is, regression equations are estimated using dummy variables to define family characteristics. The resultant coefficients are used to predict coefficients for 1968 on the assumption of no utilization fees. The 1968 predicted coefficients and the coefficients estimated from 1968 data are then evaluated to get point estimates of average utilization by type of family. The differences in the two sets of estimates indicate the effect of the utilization fee. This procedure is repeated for each of the seven categories of service listed above.⁹

The effects of utilization fees on "complete examinations" are presented in Table 6.12. Surprisingly the percentage changes are, with few exceptions, positive. Only seven of the family categories show a negative change. This would suggest that the imposition of a \$1.50 utilization fee led to an increase in the quantity of complete examinations provided to patients. This increase in complete examinations may be the result either of a shift in the preferences of patients, or of a shift in the billing practices of physicians, or of both.

Consider the hypothesis that the rise in complete examinations is attributable to a shift in billing practices of the physician. A shift in billing practices may result from either of two factors. The imposition of the utilization fee reduced the net return to the physician

⁹See the Statistical Appendix for all the tables underlying the procedure.

TABLE 6.12

PER CENT CHANGE IN QUANTITY OF COMPLETE EXAMINATIONS
PER FAMILY WITH UTILIZATION FEES

	18-24	25-34	35-44	Age of Family Head			75+
				45-54	55-64	65-74	
Couples							
0 children	20.73	25.00	24.36	17.07	22.89	12.00	19.15
1 child	8.26	8.74	10.26	5.79	9.84	3.60	8.27
2 children	12.24	13.18	13.99	10.20	13.51	7.88	11.95
3 children	5.85	5.88	7.19	4.09	6.98	2.65	6.01
4 children	6.94	7.10	8.28	5.20	8.05	3.66	7.03
5+ children	8.60	8.93	9.89	6.99	9.63	5.39	8.59
Single Male							
0 children	50.0	250.00	72.22	36.36	56.52	15.00	35.29
1 child	6.56	6.98	10.53	1.64	9.68	-1.27	6.85
2 children	13.79	15.94	16.87	10.34	15.91	6.67	13.13
3 children	3.60	3.23	5.61	0.90	5.36	-0.78	4.07
4 children	5.31	5.26	7.34	2.65	7.02	0.76	5.60
5+ children	7.94	8.33	9.84	5.56	9.45	3.47	7.97
Single Female							
0 children	20.0	29.63	26.83	13.33	23.91	6.35	17.54
1 child	2.38	1.52	5.00	-1.19	4.71	-2.94	3.13
2 children	9.09	9.78	11.32	6.36	10.81	3.91	9.02
3 children	1.49	0.86	3.08	-0.75	2.96	-1.97	2.05
4 children	2.94	2.54	4.55	0.74	4.38	-0.65	3.38
5+ children	5.37	5.34	6.90	3.36	6.67	1.80	5.59

from a patient contact.¹⁰ In the case of a regional examination, the general practitioner receives from the Commission 85 per cent of \$4.00 minus the utilization fee. A complete examination for an adult yields 85 per cent of \$8.00 minus the utilization fee.¹¹ The additional revenue may induce the physician to perform complete examinations or to submit claims for them instead of regional examinations whenever possible.

A second possibility is that the shift to complete examinations arose from confusion surrounding the change in the fee schedule in August 1968. The fee schedule change involved the replacement of "repeat visits" with "regional examinations." The possibility of confusion is indicated as the Saskatchewan Medical Association later found it necessary to remind members of the nature and definition of a complete examination.¹²

An attempt to determine whether or not the shift in billing practices might be attributable to the utilization fee or to the change in the fee schedule was made by examining the timing of the shift. As mentioned earlier, the 1968 experience may be divided into three periods: the period prior to the introduction of utilization fees (April 15th); the period after such fees but before the change in the fee schedule; and the remaining period. A regression equation was

¹⁰This refers to the net return from the Commission, of course, since the physician could recoup the utilization fee from the patient. Whether or not the patient pays the fee does not affect the argument.

¹¹Under the old fee schedule the equivalent of a regional examination by a general practitioner was a B009; the equivalent of a complete examination for an adult was a B005.

¹²Saskatchewan Medical Association, Newsletter, X, No. 7 (August 5, 1970).

fitted to the second period data on quantity of complete examinations and the family dummy variables. The estimated coefficients were then weighted by an amount sufficient to make the period equal to one year. Finally, point estimates of average utilization were calculated. Table 6.13 contains a comparison of these estimates with the predicted 1968 estimates in terms of percentage change.

The figures in Table 6.13 indicate the amount (in percentages) that family utilization of complete examinations (estimated using the data for the second period) exceeds (or falls short of) estimates for 1968 on the assumption that there were no utilization fees. The fact that the changes are generally positive suggests that the shift in billing practices occurred before the change in the fee schedule. These estimates, therefore, support the hypothesis that the shift to complete examinations may be attributed to the effect of utilization fees on the net return to physicians per patient contact.

The results are also consistent with the hypothesis that a change occurred in the preferences of patients. Patients, it may be argued, who go to the physician with an ailment requiring a regional examination, may request a complete examination since in either case they must pay the utilization fee. If this were the case, however, one would expect the shift to complete examinations to continue through the rest of the year. Calculations similar to those performed above and presented in Table 6.13 were done using the data for the period after the change in the fee schedule. In this case, the percentage changes were generally negative. Thus, complete examinations for 1968 based on the third period were less than estimated complete examinations assuming no utilization fee. It would seem then that the shift

TABLE 6.13
 PER CENT CHANGE IN QUANTITY OF COMPLETE EXAMINATIONS PER FAMILY
 DUE TO UTILIZATION FEES, APRIL 15-JULY 31 DATA

	Age of Family Head						
	18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples							
0 children	- 4.52	- 1.24	- 2.85	- 3.35	- 2.91	7.19	- 7.62
1 child	6.99	11.92	8.83	7.98	8.25	15.34	3.12
2 children	7.02	10.93	8.53	7.84	8.06	13.98	3.76
3 children	16.89	22.18	18.69	17.73	17.89	22.97	12.85
4 children	14.99	19.80	16.66	15.79	15.96	20.99	11.23
5+ children	13.20	17.28	14.67	13.92	14.08	18.80	9.89
Single Male							
0 children	-26.61	-55.11	-26.19	-23.98	-22.25	6.98	-25.85
1 child	6.66	19.03	10.46	8.63	9.16	22.28	- 0.09
2 children	6.81	14.27	9.41	8.19	8.57	18.16	1.72
3 children	22.81	34.17	26.19	24.24	24.46	31.91	15.76
4 children	19.52	29.29	22.53	20.84	21.08	28.48	13.20
5+ children	16.23	23.66	18.66	17.35	17.58	24.33	11.04
Single Female							
0 children	-13.72	-13.15	-11.95	-11.97	-11.13	5.77	-16.21
1 child	5.83	13.20	8.43	7.24	7.63	17.54	0.79
2 children	6.15	11.43	8.12	7.22	7.52	15.27	2.09
3 children	19.05	26.79	21.53	20.16	20.36	26.70	13.68
4 children	16.52	23.36	18.78	17.56	17.77	24.06	11.62
5+ children	14.10	19.62	16.01	15.02	15.22	21.02	9.93

to complete examinations cannot be accounted for by a change in patient preferences in response to the imposition of utilization fees.

Turning to the effects of utilization fees on regional examinations, presented in Table 6.14, large declines may be noted. These reductions, of course, may be partly explained by the phenomenon referred to above. That is, some of the decline in regional examinations resulted from the change in billing practices. The size of the reductions, however, probably cannot be entirely accounted for by this change. Some decline in such services to families did undoubtedly occur.

The estimated changes in home and emergency visits, Table 6.15, also indicate reduced services to families as a result of the utilization fee. In view of the fact that a \$2.00 fee was instituted for such visits, and compared with the other service types, the amount of the reductions are relatively modest. On the other hand, if such services are necessities very little reduction should have occurred.

The estimates for hospital visits are presented in Table 6.16. While no utilization fee is applicable for physicians' hospital visits, a charge of \$2.50 per day was assessed by the hospitals on the patient effective April 15, 1968. Since this is a per diem assessment, the cost to a patient would probably be larger per disease episode than the utilization fee on other physicians' services. Furthermore, the decision to hospitalize, or to remain in the hospital, is primarily a physician decision. It is interesting to note, therefore, that by charging patients a hospital utilization fee, hospital visits by physicians decline, although the amount of the decline is relatively smaller than for other service types.

TABLE 6.14
PER CENT CHANGE IN QUANTITY OF REGIONAL EXAMINATIONS

	Age of Family Head						
	18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples							
0 children	-19.07	28.08	-17.98	-20.60	-23.55	-28.67	-19.85
1 child	-27.89	- 2.55	-26.92	-28.31	-29.62	-32.61	-26.82
2 children	-29.10	- 8.96	-28.27	-29.38	-30.41	-32.91	-28.00
3 children	-30.67	-13.61	-29.91	-30.84	-31.65	-33.77	-29.47
4 children	-32.60	-18.12	-31.90	-32.67	-33.27	-35.03	-31.29
5+ children	-29.07	-15.73	-28.49	-29.27	-30.03	-31.92	-28.27
Single Male							
0 children	-18.80	638.10	-15.56	-22.98	-28.70	-36.31	-20.55
1 child	-34.93	-16.32	-32.86	-34.83	-35.94	-39.17	-31.21
2 children	-34.92	- 1.37	-33.40	-34.85	-35.71	-38.38	-31.99
3 children	-36.16	-10.40	-34.87	-36.01	-36.62	-38.80	-33.43
4 children	-37.90	-17.63	-36.79	-37.67	-38.05	-39.78	-35.28
5+ children	-32.48	-14.37	-31.63	-32.57	-33.30	-35.36	-30.94
Single Female							
0 children	-18.59	115.53	-16.59	-21.40	-25.96	-32.78	-20.00
1 child	-31.65	7.48	-30.11	-31.89	-33.21	-36.48	-29.29
2 children	-32.41	- 4.47	-31.19	-32.54	-33.54	-36.22	-30.34
3 children	-33.90	-11.57	-32.83	-33.91	-34.65	-36.87	-31.85
4 children	-35.81	-17.71	-34.86	-35.71	-36.21	-37.99	-33.74
5+ children	-31.14	-14.79	-30.40	-31.28	-32.04	-34.07	-29.91

TABLE 6.15
PER CENT CHANGE IN QUANTITY OF HOME AND EMERGENCY VISITS

	Age of Family Head						
	18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples							
0 children	-14.29	-13.33	-19.15	-10.00	-17.65	-23.33	-16.16
1 child	-22.00	-21.88	-24.49	-22.22	-23.53	-25.53	-18.88
2 children	-18.15	-18.03	-20.16	-17.76	-19.53	-22.16	-17.45
3 children	-19.87	-19.73	-21.48	-19.70	-20.92	-22.92	-18.33
4 children	-24.43	-24.42	-25.86	-24.84	-25.28	-26.27	-20.92
5+ children	-25.91	-25.93	-27.06	-26.37	-26.58	-27.20	-22.22
Single Male							
0 children	+ 4.76	11.76	- 5.26	250.00	- 4.35	-20.97	-14.12
1 child	-19.44	-19.12	-22.86	-18.87	-21.62	-24.78	-17.65
2 children	-15.31	-14.89	-17.71	-13.92	-17.00	-20.79	-16.19
3 children	-17.89	-17.65	-19.83	-17.31	-19.20	-21.95	-17.28
4 children	-23.65	-23.61	-25.34	-24.03	-24.67	-25.93	-20.20
5+ children	-25.52	-25.53	-26.84	-26.01	-26.29	-27.04	-21.70
Single Female							
0 children	- 5.56	- 3.13	-11.76	11.76	-10.53	-20.78	-14.59
1 child	-19.54	-19.28	-22.35	-19.12	-21.35	-24.22	-17.80
2 children	-15.93	-15.60	-18.02	-14.89	-17.39	-20.78	-16.41
3 children	-18.12	-17.91	-19.85	-17.65	-19.29	-21.79	-17.42
4 children	-23.31	-23.27	-24.84	-23.61	-24.24	-25.56	-20.19
5+ children	-25.12	-25.12	-26.34	-25.53	-25.84	-26.61	-21.63

TABLE 6.16
PER CENT CHANGE IN QUANTITY OF HOSPITAL VISITS

	18-24	25-34	35-44	Age of Family Head			75+
				45-54	55-64	65-74	
Couples							
0 children	-20.22	-21.05	-16.67	-10.28	-6.91	-7.29	-12.55
1 child	-15.06	-15.04	-13.51	-11.28	-8.84	-8.30	-12.48
2 children	0.00	0.98	3.00	2.98	0.27	-3.25	-9.66
3 children	-23.67	-24.04	-22.97	-20.13	-15.32	-12.24	-14.65
4 children	-10.26	-10.06	-8.98	-7.86	-6.89	-7.15	-11.42
5+ children	-9.53	-9.38	-8.65	-7.89	-7.15	-7.29	-11.04
Single Male							
0 children	-28.26	-30.38	-26.67	-17.27	-10.04	-8.70	-13.27
1 child	-18.18	-18.34	-16.89	-14.23	-10.78	-9.40	-13.11
2 children	-3.64	-2.90	0.99	0.42	1.78	4.41	-10.31
3 children	-26.07	-26.55	-25.52	-22.43	-16.96	-13.24	-15.24
4 children	-12.43	-12.32	-11.28	-9.95	-8.41	-8.11	-12.00
5+ children	-11.03	-10.91	-10.20	-9.35	-8.31	-8.09	-11.55
Single Female							
0 children	116.67	460.00	2700.00	77.78	12.57	-0.21	-9.48
1 child	1.79	3.23	5.96	5.38	1.23	-3.03	-9.81
2 children	26.71	30.83	34.88	28.05	13.20	2.81	-6.76
3 children	-13.97	-13.89	-12.26	-10.12	-8.03	-7.84	-12.25
4 children	1.07	1.97	3.42	3.36	0.92	-2.57	-8.93
5+ children	-2.26	-1.86	-0.94	-0.65	-1.50	-3.54	-8.82

Laboratory services, like hospitalization, are also primarily physician elective. Table 6.17 indicates rather large reductions in the use of laboratory services as a result of utilization fees. Part of these reductions may be associated with the change in billing practices. Complete examinations increased while regional examinations declined. Complete examinations are usually associated with more laboratory work than regional examinations.¹³ However, if the increase in complete examinations were only nominal, i.e., they were regional examinations billed as complete examinations, then there would be no associated tendency for laboratory services to rise. Thus, the rise in complete examinations together with a decline in laboratory services tends to confirm the billing shift hypothesis. In addition, the reduction in laboratory services is probably an indication of reductions in real services to families. Regional examinations declined probably by less than the amounts indicated in Table 6.14; complete examinations may also have declined if the nominal increase through the shift in billing practices was large enough to offset real reductions. The magnitude of the reductions in laboratory work would suggest that there must have been real reductions in both of these types of service.

Estimates for major surgery and minor surgery are presented in Tables 6.18 and 6.19 respectively. These services types are also physician elective. The former has no physician utilization fee, although, as mentioned above, such fees may apply for the latter. Utilization of such services should only be affected by utilization fees through the failure to discover the need for surgery. Assuming

¹³Dr. D. Penman, Medical Director, Medical Care Insurance Commission.

TABLE 6.17
PER CENT CHANGE IN QUANTITY OF LABORATORY SERVICES

		Age of Family Head						
		18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples								
0 children		10.32	8.04	3.90	- 0.61	- 2.08	- 7.51	1.43
1 child		- 3.22	- 6.05	- 6.28	- 9.33	-10.33	-13.52	- 7.29
2 children		-19.68	-22.53	-20.21	-21.93	-22.49	-23.49	-20.00
3 children		-39.18	41.98	-38.14	-38.95	-39.19	-38.48	-37.06
4 children		-51.95	-54.47	-50.41	-50.80	-50.89	-49.49	-49.07
5+ children		-59.15	-61.34	-57.56	-57.76	-57.79	-56.23	-56.22
Single Male								
0 children		19.57	5.56	- 4.90	-15.57	-18.46	-23.19	- 8.39
1 child		-20.59	-33.33	-21.88	-26.42	-27.73	-28.62	-21.03
2 children		-39.06	-46.10	-36.83	-38.61	-39.11	-37.77	-34.77
3 children		-58.68	-63.85	-55.30	-55.81	-55.90	-53.02	-52.68
4 children		-69.27	-73.26	-66.06	-66.16	-66.13	-63.06	-63.59
5+ children		-73.89	-77.02	-71.14	-71.12	-71.05	-68.27	-69.01
Single Female								
0 children		11.03	6.48	0.52	- 6.13	- 8.18	-14.14	- 2.58
1 child		- 9.73	-15.15	-12.77	-16.56	-17.74	-20.41	-13.31
2 children		-28.42	-32.87	-27.99	-29.81	-30.36	-30.47	-27.07
3 children		-48.73	-52.58	-46.68	-47.38	-47.56	-45.88	-44.91
4 children		-60.79	-64.01	-58.47	-58.73	-58.76	-56.57	-56.59
5+ children		-66.86	-69.52	-64.71	-64.80	-64.79	-62.62	-62.98

TABLE 6.18
PER CENT CHANGE IN QUANTITY OF MAJOR SURGERY

		Age of Family Head						
		18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples								
0 children		2.63	9.68	1.89	- 1.45	- 6.98	- 8.57	- 2.22
1 child		- 8.33	- 4.88	- 6.35	- 7.59	-11.46	-12.17	- 7.00
2 children		- 7.40	- 4.26	- 5.80	- 7.06	-10.78	-11.57	- 6.60
3 children		-13.04	-11.29	-10.71	-11.00	-13.68	-13.97	- 9.92
4 children		-24.00	-23.53	-20.00	-18.87	-20.33	-19.72	-16.54
5+ children		- 9.64	- 7.89	- 8.16	- 8.77	-11.45	-12.00	- 8.15
Single Male								
0 children		40.00	2.00	10.00	0.00	- 9.43	-11.11	-12.28
1 child		-20.00	-12.50	-10.00	-10.87	-15.87	-15.85	- 8.96
2 children		-14.29	- 7.14	- 8.33	- 9.62	-14.49	-14.77	- 8.22
3 children		-22.22	-20.69	-15.69	-14.93	-17.86	-17.48	-12.50
4 children		-40.48	-42.86	-29.82	-26.03	-26.67	-24.77	-21.28
5+ children		-14.00	-11.63	-10.77	-11.11	-14.29	-14.53	- 9.80
Single Female								
0 children		0.00	0.00	0.00	- 5.26	-12.73	-13.51	- 5.08
1 child		-29.41	-30.00	-15.63	-14.58	-18.46	-17.86	-11.59
2 children		-21.74	-18.75	-13.16	-12.96	-16.90	-16.67	-10.67
3 children		-26.32	-25.81	-18.87	-17.39	-19.77	-19.05	-14.44
4 children		-43.18	-45.95	-32.20	-28.00	-28.26	-26.13	-22.92
5+ children		-17.31	-15.56	-13.43	-13.25	-16.00	-15.97	-11.54

TABLE 6.19
PER CENT CHANGE IN QUANTITY OF MINOR SURGERY

		Age of Family Head						
		18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples								
0 children		- 5.26	20.00	-11.76	0.00	-12.50	-20.00	0.00
1 child		-12.90	- 4.55	-17.24	-10.71	-17.86	-22.22	-12.00
2 children		-16.28	-11.76	-19.51	-15.00	-20.00	-23.08	-16.22
3 children		-15.69	-11.90	-18.37	-14.58	-18.75	-21.28	-15.56
4 children		-10.53	- 6.25	-12.73	- 9.26	-12.96	-15.09	- 9.80
5+ children		-13.89	-11.11	-15.71	-13.04	-15.94	-17.65	-13.64
Single Male								
0 children		0.00	150.00	-11.11	12.50	-12.50	-28.57	20.00
1 child		-13.04	0.00	-19.05	-10.00	-20.00	-26.32	-11.76
2 children		-17.14	-11.54	-21.21	-15.63	-21.88	-25.81	-17.24
3 children		-16.28	-11.76	-19.51	-15.00	-20.00	-23.08	-16.22
4 children		-10.20	- 5.00	-12.77	- 8.70	-13.04	-15.56	- 9.30
5+ children		-14.06	-10.91	-16.13	-13.11	-16.39	-18.33	-13.79
Single Female								
0 children		- 9.09	100.00	-22.22	0.00	-25.00	-42.86	0.00
1 child		-17.39	- 7.14	-23.81	-15.00	-25.00	-31.58	-17.65
2 children		-20.00	-15.38	-24.24	-18.75	-25.00	-29.03	-20.69
3 children		-18.60	-14.71	-21.95	-17.50	-22.50	-25.64	-18.92
4 children		-12.24	- 7.50	-14.89	-10.87	-15.22	-17.78	-11.63
5+ children		-15.63	-12.73	-17.74	-14.75	-18.03	-20.00	-15.52

that surgery is a necessary service, especially major surgery, the decline in these services, indicated in the tables, represent a serious erosion of the quality of medical care. These reductions may, if such is the case, represent only temporary economies. Alternatively, it may be argued that the observed decline in surgery represents overservicing by physicians--that is, unnecessary services. Resolution of this question, however, would involve a more detailed analysis of the change in the composition of surgical services, an investigation beyond the scope of this study.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The principal objectives of this study were twofold. The first objective was to compile data on family medical expenditure and family income in such a way that it could be assembled for more detailed analysis of family utilization of physicians' services than has previously been possible. The second objective was to provide some estimates of the effects of income and utilization fees on family expenditure for medical care. In addition, other socio-demographic variables were examined for their explanatory effects on family consumption of medical services.

In Chapter One, the nature of public medical care insurance was examined. The rationale and arguments attending the introduction of the Federal Medical Care Act were considered along with a discussion of the relationship of private insurance and prepayment to social insurance. It was argued that social insurance combines the risk pooling attributes of private insurance with the emphasis on distribution and provision of services found in prepayment plans.

While the objectives of private insurance and prepayment may be embraced by social insurance, the policy tools available to each may not. On the one hand, since a redistribution of income is implied in social insurance, and the schemes are generally compulsory, premiums need not be related to anticipated benefits. If the purpose of social

insurance is to make medical services accessible to low income classes, then the premium cannot be experience rated. Therefore, premiums, or costs to the individual, are divorced from benefits.

The ability to focus policy on benefits, on the other hand, is also limited under social insurance. Benefits are generally broad in keeping with the desire to provide comprehensive care. Exclusions in coverage, preconditions, limits on the amount payable, utilization fees, all may be inconsistent with the overall objective of the social insurance scheme. Nevertheless, there is the general belief that in order to control the rate of increase in the costs of medical care some device must be introduced to relate benefits to costs. The success of such a device, however, must be evaluated not only in terms of its ability to control overall costs, but also in terms of its impact on the distribution of medical services.

This study is primarily concerned with the use of utilization fees as such a device. The major premise upon which the study is based is that the effects of utilization fees are a function of their effect on the distribution or provision of medical services. No attempt was made to examine their other effects, for example, their effect upon the quality of medical care.

The Saskatchewan experience was chosen for this study because it is North America's only public medical care insurance plan that had operated for several years without utilization fees. In 1968 such fees were introduced providing a unique opportunity to study their effects.

Since this study draws upon data not previously available, considerable effort was made to define the nature, and the method of

collection, the data. The agencies providing the data and the characteristics of data collection were examined in Chapter Two. The data sources for the study were the Saskatchewan Hospital Services Plan, the Saskatchewan Medical Care Insurance Commission, and the Saskatchewan Treasury Department.

The Saskatchewan Hospital Services Plan patient identification system was examined in considerable detail, since this system is used by the Medical Care Plan and, therefore, imposes a definition of the family on the study. The operations of the Saskatchewan Medical Care Insurance Commission were discussed in order to establish the nature and reliability of the data collected on medical care expenditures. The major features of the plan are that it operates on a fee-for-service basis, providing fairly comprehensive coverage to beneficiaries. The claims submitted by physicians for services rendered to patients provide the data on family medical care utilization. It was noted that these claims are assessed and processed in such a manner as to ensure a very high degree of accuracy in the data.

The Saskatchewan Treasury Department provided family income data from their copies of personal income tax returns. The definition of income used in this study, therefore, is that imposed by the data source. While there are inevitably some deficiencies in such data, it was argued that such deficiencies were not significant enough to impair the study, and were probably less than those in data from other sources.

This study was based upon a sample of families drawn from the files of the Saskatchewan Hospital Services Plan. Repeated cross section random samples of families were drawn for each of the years

1963 through 1968. The method of selection of the samples and the representativeness of the samples were discussed in Chapter Three. While only one random sample of families was drawn from the Master Registration File of the Saskatchewan Hospital Services Plan, this overall sample was sorted into annual sub-samples. These sub-samples were constructed in such a way that they are the equivalent of cross section samples drawn at the end of each of the respective years. The samples were shown to be representative of the population when examined by such characteristics as family size, medical expenditure, and income. The latter characteristic, income, was considered to be of particular importance since the income files and the medical care files were linked through a name and address search.

The method of analysis used in this study was single equation regressions fitted by ordinary least squares. Expenditures on medical care and quantity of services were used as the dependent variables in alternative regression models although only the equations using quantity of services were used for the analysis of the effects of utilization fees. A fee schedule change in mid-1968 rendered expenditures less useful. The independent variables in the analysis, discussed in Chapter Four, were family income, a variable measuring any direct charges incurred by the family for physicians' services, location of the family, presence of spouse, age of the family head, and number of children. The latter four variables were treated as dummy variables and defined in such a way as to allow comparability with a previous study commissioned by the Hall Commission using data from Manitoba Medical Services Incorporated.

The method of analyzing the effects of the utilization fee on

family expenditure for medical care in 1968 required the use of the coefficients estimated for the cross section equations. The cross section equations were re-estimated using only the dummy variables (excluding location) as independent variables. The resulting coefficients constitute an additive model that may be evaluated to get point estimates of average utilization by type of family. A set of such coefficients was predicted for 1968, assuming no utilization fee, by regressing the individual coefficients of the cross section equations against time. These predicted coefficients were evaluated to get utilization estimates and then compared with similar estimates based upon the 1968 data.

The results of the cross section analysis and of the analysis of the effects of the utilization fee were presented in Chapters Five and Six. These results are summarized in the following section.

Major Findings

While the primary purpose of this study was to assess the impact of utilization fees on family expenditure for physicians' services, a number of other relationships were examined in the course of doing so. The findings of the study, therefore, range wider than the question of the effects of utilization fees. These findings are reviewed below.

1. While the imposition of utilization fees reduced the government's costs of medical care insurance by six to seven per cent in 1968, this reduction fell heavily on certain categories of families. The range of the impact of utilization fees varied from little or no effect to reductions in services of up to 24 per cent for some categories of

families. In general, the greatest reductions occurred among large families and among those families whose head was in the upper age classes. The utilization fee, therefore, resulted in reduced services to the aged and to large families. These conclusions must be regarded as tentative since many of the 1968 predicted values were not statistically significant.

2. The introduction of utilization fees elicited a shift in the billing practices of physicians. The number of complete examinations increased after utilization fees compared with predictions assuming no utilization fee. The timing and duration of this shift suggest that it was primarily in response to the effect of utilization fees on physicians' earnings. The increase in complete examinations would seem to have occurred because regional examinations were being billed as complete examinations. Thus, the observed increase in complete examinations in 1968 was, it is suggested, only nominal; it probably did not represent increased real services to families.

3. Both services that tend to be primarily patient elective and services that are primarily physician elective declined. After utilization fees were introduced, a decline was observed for major surgery, minor surgery, laboratory services, and hospital visits.

4. The income elasticity of demand for physicians' services is positive in sign but very small. For 1963, the estimated elasticity was 0.05. This estimate supports the contention that medical care insurance removes income as a barrier to health services.

5. The income elasticity of demand for physicians' services declines

over time under medical care insurance. By 1967, the income elasticity had fallen to 0.02. Under insurance income may serve as a proxy for tastes. The secular decline in income elasticity suggests a negative learning effect over time. That is, habits formed prior to the introduction of insurance and associated with income class are eroded with increased familiarity and experience under medical care insurance.

6. The relationship between income and medical expenditure is not positive for all types of medical services. In particular, the relationship between income and family expenditure for physicians' hospital visits is negative. The coefficients, although small in magnitude, suggest that increased income is associated with lower expenditures for hospital visits. It was not possible to determine whether this means that hospitalization results in a loss of income or whether low income groups use hospitals more than high income groups.
7. The practice of billing patients directly for physicians' services did not, the analysis seems to indicate, result in reduced expenditures for such services. When the patient is billed directly the amount of reimbursement received from the Medical Care Commission may be less than the amount sought by the physician. The difference constitutes a direct charge on the patient. The observed response to this direct charge, however, may reflect more the high generated costs per patient of the practitioners who "direct bill" than the behavioural patterns of patients. It cannot be concluded that a large scale switch to direct billing would result in increased expenditures for medical care.
8. There is a large, and growing, differential between rural and

urban families' utilization of medical services. In 1963 urban families spent, on the average, \$7.44 more on medical services than did rural families. This amount may be compared with the estimate of \$19.44 for average expense of all couples, head aged 18-24 years, and no children. By 1967 the rural-urban differential grew to \$11.99 (as compared to \$46.91) for couples as above. The rural-urban differential is large in the case of laboratory services. By 1967, urban families spent an estimated \$5.99 more on laboratory services than did rural families (as compared with \$1.63 for couples). Some of this difference, however, is attributable to the performance of laboratory tests in rural hospitals. As might be predicted, rural families apparently used general practitioners more, and specialists less, than did their urban counterparts.

9. In only two of the years from 1963 through 1967 was a U-shaped relation between age of the family head and medical expenditure found. The remaining years suggested a linear relation between age and medical expenditure.

10. Extra medical expenditures associated with additional children diminish as family size increases. That is, there is a declining marginal medical expenditure associated with extra children.

Further Research

With the introduction of public medical care insurance programs a new wealth of data is made available so that many aspects of the health care delivery system are amenable to empirical analysis. This study focuses on one aspect of that system. It does not exhaust the

potential of the data nor are alternative ways of examining the same questions considered. The necessity of confining the scope of the study precluded the former; limitations on time and resources restrict the latter. Thus, the possibilities for further research arising out of this study are bountiful. The following ideas will serve at least to illustrate some of the possibilities that might be explored.

The present study analyzes the effects of utilization fees on family expenditures for physicians' services on the implicit assumption that the impact occurs in the first year that such a policy is in force. That is, it is assumed that the imposition of utilization fees causes a shift in the behavioural function describing family utilization of medical services. In this sense, the analysis is static. It is becoming increasingly apparent, as more data on the post-utilization fee period becomes available, that there are also some dynamic effects involved. The possibility of utilization fees exhibiting a "shock" effect should be considered. In addition, there is the further possibility of a postponed consumption, or pent-up demand, effect. That is, the imposition of utilization fees may cause an immediate reduction in utilization as remedies for latent needs are not sought. If, however, remedial action is merely postponed, future rates of acceleration in medical care costs may be expected to rise.

Inclusion in the analysis of experience more than one year after the introduction of utilization fees would further increase the difficulty of predicting behaviour in the absence of utilization fees. The brevity of the time series observations, it will be recalled, makes it difficult to get statistically significant results. A possible solution is to pool the cross section samples and use the pooled

sample to estimate equations for prediction purposes. A shift variable could be introduced to separate the periods before and after the utilization fee. In addition, time could then be explicitly introduced in the model.

One of the restrictions imposed by the regression model used in the present study was the inability to handle interactions effects between variables. Alternative specifications of the model, incorporating interactions variables, could be estimated. For example, the relation between age and location might be examined to determine why the coefficients for the 75 and over age class behave as they do. Further, an interactions model might shed light on the expenditure patterns of large families (five or more children). Finally, interactions variables might be used to investigate the relationships between income classes and the demographic variables.

An analysis of utilization by income class is perhaps the most deserving of future effort. A major question in evaluating public medical care insurance programs is whether they remove income as a barrier to medical care. The income elasticities estimated in the present study, while yielding estimates of the association between income and medical expenditure on the average, do not indicate the range of disparity in use of physicians' services between low income classes and high income classes. Information on the distribution of medical expenditures by income class would allow an examination of the probable effects of such policies as deductibles and limits on the amount payable.

A regression model could also be used to explore further the differences in utilization of various medical services by income class.

Disaggregating the sample by income class would allow the estimation of separate regression equations for each income class. Such an analysis would reveal the role that various explanatory variables play for each income category.

These suggestions, of course, do not exhaust the possibilities for further research in this area. As this relatively new social program makes more data available, further refinements and explorations will be made. This study, as a first step, serves to illustrate that such data may be used by researchers without violating the agencies' rigorous standards of confidentiality.

APPENDICES

APPENDIX A

STATISTICAL APPENDIX

TABLE A.1
 NUMBER OF FAMILIES WITH COVERAGE DURING 1963, BY
 AGE OF HOUSEHOLD HEAD AND SIZE OF FAMILY

Type of Family	18-24	25-34	35-44	Age of Family Head			75+
				45-54	55-64	65-74	
Couples							
0 children	1413	667	366	1057	1961	1672	864
1 child	742	736	503	983	633	133	26
2 children	476	1410	1169	936	315	26	5
3 children	151	1070	1133	553	122	13	2
4 children	55	652	831	350	66	10	1
5+ children	12	495	1002	368	65	6	1
Single Males							
0 children	1543	974	854	782	762	686	1034
1 child	22	30	27	43	103	162	167
2 children	28	20	19	34	31	3	1
3 children	19	30	24	38	22	4	0
4 children	8	28	21	13	6	2	0
5+ children	4	44	45	35	10	0	1
Single Females							
0 children	2013	556	406	662	944	1149	1430
1 child	137	80	97	121	68	17	8
2 children	49	68	61	51	6	1	1
3 children	16	49	45	25	3	1	0
4 children	5	33	33	8	0	0	0
5+ children	7	36	38	6	1	0	0

Note: There are 12 missing observations, probably because age is greater than 100 years.

TABLE A.2

NUMBER OF FAMILIES WITH COVERAGE DURING 1964, BY
AGE OF HOUSEHOLD HEAD AND SIZE OF FAMILY

Type of Family	18-24	25-34	35-44	Age of Family Head			75+
				45-54	55-64	65-74	
Couples							
0 children	1429	735	352	968	1913	1712	996
1 child	607	818	479	945	707	155	33
2 children	328	1413	1147	976	368	35	6
3 children	89	1033	1132	620	141	16	3
4 children	25	587	865	391	75	12	1
5+ children	5	419	991	439	82	7	1
Single Males							
0 children	1932	1006	864	789	749	668	1089
1 child	21	24	30	45	93	158	182
2 children	22	23	20	33	31	4	1
3 children	15	30	23	37	26	4	0
4 children	8	27	19	14	6	2	0
5+ children	4	40	49	34	13	0	1
Single Females							
0 children	2578	616	405	615	908	1127	1495
1 child	119	80	90	120	74	20	8
2 children	42	60	61	51	9	1	1
3 children	9	47	46	29	3	1	0
4 children	2	28	39	8	0	0	0
5+ children	3	33	39	6	1	0	0

Note: There are 7 missing observations, probably because age is greater than 100 years.

TABLE A.3
 NUMBER OF FAMILIES WITH COVERAGE DURING 1965, BY
 AGE OF HOUSEHOLD HEAD AND SIZE OF FAMILY

Type of Family	Age of Family Head						
	18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples							
0 children	1450	822	323	842	1802	1686	1121
1 child	460	804	436	877	755	182	41
2 children	210	1314	1142	1007	412	45	6
3 children	51	916	1066	678	168	17	3
4 children	13	490	850	433	92	14	2
5+ children	4	306	981	514	92	13	1
Single Males							
0 children	2023	882	830	748	697	644	1011
1 child	17	24	29	33	91	146	201
2 children	21	24	19	33	31	4	2
3 children	12	29	23	37	26	5	1
4 children	6	26	16	17	6	2	0
5+ children	2	39	51	34	16	6	1
Single Females							
0 children	2153	473	340	550	806	1066	1453
1 child	95	71	67	124	74	23	8
2 children	31	52	52	48	14	1	1
3 children	6	37	43	24	6	0	0
4 children	3	21	27	11	0	0	0
5+ children	0	27	37	7	1	0	0

Note: There are 5 missing observations, probably because age is greater than 100 years.

TABLE A.4

NUMBER OF FAMILIES WITH COVERAGE DURING 1966, BY
AGE OF HOUSEHOLD HEAD AND SIZE OF FAMILY

Type of Family	18-24	25-34	35-44	Age of Family Head			75+
				45-54	55-64	65-74	
Couples							
0 children	1407	915	307	713	1708	1697	1266
1 child	342	837	409	814	816	206	49
2 children	129	1226	1108	1029	482	57	7
3 children	29	789	1055	753	197	22	3
4 children	7	420	807	495	108	16	1
5+ children	1	234	956	581	100	19	3
Single Males							
0 children	2440	884	794	740	660	638	968
1 child	14	23	25	34	79	137	213
2 children	18	24	18	26	33	5	3
3 children	9	25	22	38	27	5	1
4 children	2	27	19	18	7	3	0
5+ children	2	25	55	38	19	1	1
Single Females							
0 children	2276	463	311	506	766	984	1458
1 child	83	54	62	110	83	22	13
2 children	23	43	48	48	20	2	1
3 children	8	34	41	26	6	0	0
4 children	2	19	20	13	0	0	0
5+ children	0	22	32	10	2	0	0

Note: There are 4 missing observations, probably because age is greater than 100 years.

TABLE A.5
 NUMBER OF FAMILIES WITH COVERAGE DURING 1968, BY
 AGE OF HOUSEHOLD HEAD AND SIZE OF FAMILY

Type of Family	Age of Family Head						
	18-24	25-34	35-44	45-54	55-64	65-74	75+
Couples							
0 children	791	848	299	1082	2280	2041	1393
1 child	399	918	431	951	740	118	18
2 children	100	1216	1116	952	349	55	9
3 children	15	686	1056	662	131	19	0
4 children	1	345	801	394	62	12	0
5+ children	0	168	817	428	61	8	3
Single Males							
0 children	3379	1091	792	757	754	673	1004
1 child	10	15	22	24	32	47	50
2 children	9	17	13	19	18	5	0
3 children	3	16	16	13	13	0	0
4 children	1	12	12	11	4	0	0
5+ children	1	14	24	11	6	1	1
Single Females							
0 children	2431	427	282	510	759	921	1521
1 child	111	62	57	87	43	3	5
2 children	40	53	50	45	10	2	0
3 children	15	40	41	25	2	0	0
4 children	4	21	19	8	2	0	0
5+ children	1	30	40	11	0	0	0

Note: There are 5 missing observations, probably because age is greater than 100 years.

TABLE A.6
 MEANS AND STANDARD DEVIATIONS OF
 THE VARIABLES, BY YEAR

	1963	1964	1965	1966	1967	1968
TOTINC	2501.44 (3748.08)	2764.35 (4031.98)	3076.31 (4254.07)	3440.60 (4512.44)	3667.12 (4672.26)	3691.78 (4781.23)
DGG	1.05 (4.85)	0.97 (4.66)	0.83 (4.29)	0.69 (3.95)	0.58 (3.61)	0.98 (4.29)
Single Male	0.20 (0.40)	0.20 (0.40)	0.21 (0.40)	0.21 (0.41)	0.22 (0.42)	0.23 (0.42)
Single Female	0.21 (0.41)	0.22 (0.41)	0.20 (0.40)	0.20 (0.40)	0.20 (0.40)	0.20 (0.40)
Children						
One	0.12 (0.33)	0.12 (0.33)	0.12 (0.32)	0.12 (0.32)	0.11 (0.31)	0.11 (0.31)
Two	0.12 (0.33)	0.12 (0.32)	0.12 (0.32)	0.12 (0.32)	0.11 (0.31)	0.11 (0.31)
Three	0.09 (0.28)	0.08 (0.27)	0.08 (0.28)	0.08 (0.27)	0.07 (0.26)	0.07 (0.26)
Four	0.05 (0.23)	0.05 (0.22)	0.05 (0.22)	0.05 (0.22)	0.05 (0.21)	0.04 (0.21)
Five +	0.06 (0.23)	0.05 (0.23)	0.06 (0.23)	0.06 (0.23)	0.04 (0.21)	0.04 (0.20)
Age of Family Head						
25-34	0.18 (0.38)	0.18 (0.38)	0.17 (0.37)	0.16 (0.37)	0.16 (0.36)	0.16 (0.36)
35-44	0.17 (0.38)	0.17 (0.37)	0.17 (0.37)	0.16 (0.37)	0.16 (0.36)	0.15 (0.36)
45-54	0.16 (0.36)	0.15 (0.36)	0.16 (0.36)	0.16 (0.37)	0.16 (0.36)	0.16 (0.36)
55-64	0.13 (0.34)	0.13 (0.34)	0.13 (0.34)	0.14 (0.34)	0.14 (0.34)	0.14 (0.34)
65-74	0.10 (0.30)	0.10 (0.30)	0.10 (0.30)	0.10 (0.30)	0.10 (0.30)	0.10 (0.30)
75 +	0.09 (0.29)	0.10 (0.29)	0.10 (0.30)	0.11 (0.31)	0.11 (0.31)	0.10 (0.31)
Urban	0.41 (0.49)	0.41 (0.49)	0.40 (0.49)	0.40 (0.49)	0.40 (0.49)	0.40 (0.49)

TABLE A.6 (concluded)

	1963	1964	1965	1966	1967	1968
FAPP (Total)	53.97 (94.12)	60.46 (101.94)	69.16 (108.79)	70.85 (112.82)	73.74 (120.03)	77.98 (123.59)
NUMSER (Total)	9.03 (15.60)	10.43 (17.96)	12.18 (18.18)	12.80 (20.06)	13.48 (20.82)	12.94 (19.68)
NGP (Total)	3.01 (4.71)	3.47 (5.46)	4.16 (5.93)	4.30 (6.07)	4.52 (6.34)	4.44 (6.15)
NSP (Total)	1.00 (2.80)	1.23 (3.29)	1.44 (3.45)	1.53 (3.58)	1.71 (3.96)	1.82 (4.00)
FAPPGP (Total)	35.40 (60.66)	37.94 (62.84)	43.47 (65.93)	43.74 (66.93)	44.48 (66.03)	45.45 (68.02)
FAPPSP (Total)	18.30 (60.57)	22.32 (67.19)	26.09 (73.49)	27.08 (77.14)	29.24 (87.18)	32.47 (87.29)
FAPP (Anaes- thetia)	2.74 (10.69)	2.86 (10.57)	3.45 (11.95)	3.43 (12.31)	3.53 (12.11)	3.75 (13.41)
NUMSER (Anaesthesia)	0.16 (0.57)	0.17 (0.58)	0.21 (0.65)	0.20 (0.67)	0.21 (0.68)	0.23 (0.76)
FAPP (Obstetrics)	4.55 (18.97)	4.29 (18.50)	4.30 (18.51)	3.41 (16.63)	3.18 (16.09)	3.74 (19.60)
NUMSER (Obstetrics)	.06 (.25)	.06 (.25)	.06 (.27)	.05 (.22)	.04 (.21)	.04 (.21)
FAPP (Minor Surg.)	1.59 (5.40)	1.72 (5.78)	2.05 (6.67)	2.04 (6.58)	2.11 (6.94)	2.12 (7.01)
NUMSER (Minor Surg.)	.15 (.48)	.16 (.51)	.20 (.57)	.19 (.56)	.21 (.63)	.20 (.61)
FAPP (Major Surg.)	13.65 (50.38)	14.58 (51.82)	17.29 (57.18)	17.76 (59.88)	18.26 (61.50)	18.18 (64.07)
NUMSER (Major Surg.)	.31 (.95)	.36 (1.00)	.44 (1.14)	.47 (1.24)	.52 (1.31)	.53 (1.34)
FAPP (Lab.)	2.21 (6.77)	4.33 (11.62)	5.28 (13.08)	5.59 (13.65)	6.50 (15.27)	6.62 (15.03)
NUMSER (Lab.)	1.21 (2.78)	1.70 (3.72)	2.09 (4.12)	2.24 (4.30)	2.66 (4.90)	2.80 (4.99)
FAPP (Psychiatric)	.40 (7.59)	.59 (9.74)	.76 (12.01)	1.01 (12.82)	1.32 (16.38)	1.51 (17.76)
NUMSER (Psychiatric)	.04 (.78)	.07 (1.20)	.10 (2.00)	.12 (1.75)	.15 (1.96)	.14 (1.69)
FAPP (Consult.)	1.80 (6.98)	2.12 (7.34)	2.48 (8.19)	2.74 (8.74)	3.15 (9.56)	3.77 (11.91)
NUMSER (Consult.)	.10 (.37)	.11 (.41)	.14 (.45)	.15 (.48)	.18 (.53)	.19 (.57)

TABLE A.7
REGRESSION COEFFICIENTS AND STANDARD ERRORS, QUANTITY
OF COMPLETE EXAMINATIONS AND FAMILY DUMMY VARIABLES,
BY YEAR

	1963	1964	1965	1966	1967	1968
Intercept	0.43	0.49	0.59	0.55	0.81	0.99
Spouse Absent						
Single Male	-0.34 (0.02)	0.37 (0.02)	-0.42 (0.02)	-0.41 (0.02)	-0.51 (0.02)	-0.66 (0.02)
Single Female	-0.31 (0.02)	-0.35 (0.02)	-0.35 (0.02)	-0.31 (0.02)	-0.38 (0.02)	-0.45 (0.02)
Children Present ^a						
One	0.17 (0.02)	0.22 (0.02)	0.35 (0.02)	0.30 (0.02)	0.32 (0.02)	0.32 (0.03)
Two	0.36 (0.02)	0.43 (0.02)	0.57 (0.02)	0.55 (0.02)	0.56 (0.02)	0.66 (0.03)
Three	0.46 (0.02)	0.56 (0.02)	0.70 (0.03)	0.75 (0.03)	0.77 (0.03)	0.82 (0.03)
Four	0.61 (0.03)	0.71 (0.03)	0.80 (0.03)	0.85 (0.03)	0.80 (0.04)	0.86 (0.04)
Five Plus	0.76 (0.03)	0.77 (0.03)	0.98 (0.03)	0.94 (0.03)	0.94 (0.04)	1.03 (0.04)
Age of Family Head						
25-34	0.13 (0.02)	0.09 (0.02)	0.08 (0.02)	0.01* (0.02)	-0.18 (0.02)	-0.19 (0.03)
35-44	0.24 (0.02)	0.19 (0.02)	0.10 (0.02)	0.12 (0.02)	-0.01* (0.03)	-0.02* (0.03)
45-54	0.23 (0.02)	0.22 (0.02)	0.14 (0.02)	0.17 (0.02)	0.003* (0.02)	-0.03* (0.03)
55-64	0.32 (0.02)	0.29 (0.02)	0.19 (0.02)	0.20 (0.02)	0.04 (0.02)	0.03* (0.03)
65-74	0.27 (0.02)	0.31 (0.02)	0.26 (0.02)	0.28 (0.02)	0.16 (0.03)	0.13 (0.03)
75 +	0.14 (0.02)	0.16 (0.02)	0.07 (0.02)	0.18 (0.02)	0.11 (0.02)	0.13 (0.03)
R ²	0.09	0.10	0.13	0.13	0.11	0.12

^aNotes: Children coefficients not in first differences.

* Not significant at the 5% level.

TABLE A.8
 PREDICTION EQUATIONS, QUANTITY OF COMPLETE
 EXAMINATIONS FOR 1968

	A	B	\hat{Y}	F	R ²	Se
Intercept	0.33 (4.14)	0.08 (3.44)	0.82	11.81	0.73	0.36
Spouse Absent						
Single Male	0.07 (-0.69)	-0.11* (-0.98)	-0.60	0.97	0.24 ⁺	0.36
Single Female	-0.31 (-10.04)	-0.01* (-1.07)	-0.37	1.15	0.04	0.03
Children Present ^a						
One	0.16 (2.95)	0.04 (2.35)	0.39	5.53	0.53	0.05
Two	0.34 (6.13)	0.05 (3.13)	0.65	9.80	0.69	0.05
Three	0.41 (9.04)	0.08 (6.00)	0.89	35.98	0.90	0.04
Four	0.60 (10.36)	0.05 (2.99)	0.91	8.93	0.66	0.06
Five Plus	0.72 (9.51)	0.05* (2.32)	1.04	5.41	0.52	0.07
Age of Family Head						
25-34	0.24 (3.63)	-0.07 (-3.57)	-0.18	12.76	0.75	0.06
35-44	0.30 (8.02)	-0.06 (-5.07)	-0.04	25.72	0.86	0.04
45-54	0.31 (5.54)	-0.05 (-3.07)	-0.00	9.44	0.68	0.05
55-64	0.40 (8.87)	-0.07 (-4.74)	0.01	22.5	0.84	0.05
65-74	0.33 (6.69)	-0.03* (-1.68)	0.18	2.81	0.31	0.05
75 +	0.14 (2.55)	-0.004* (-0.26)	0.12	0.07	0.02 ⁺	0.05

⁺Unadjusted R².

^t statistics are in brackets below the coefficients.

* Not statistically significant at the 10% level.

^aThese coefficients are not presented in first differences.

TABLE A.9

REGRESSION COEFFICIENTS AND STANDARD ERRORS, QUANTITY
OF REGIONAL EXAMINATIONS AND FAMILY DUMMY VARIABLES,
BY YEAR

	1963	1964	1965	1966	1967	1968
Intercept	1.79	2.20	2.79	2.71	3.63	3.14
Spouse Absent						
Single Male	-1.60 (0.07)	-1.86 (0.07)	-2.14 (0.08)	-2.24 (0.08)	-2.49 (0.08)	-2.19 (0.07)
Single Female	-1.56 (0.07)	-1.79 (0.07)	-1.79 (0.08)	-1.68 (0.09)	-1.87 (0.08)	-1.52 (0.07)
Children Present ^a						
One	0.72 (0.08)	0.97 (0.08)	1.59 (0.09)	1.64 (0.10)	1.78 (0.10)	1.23 (0.09)
Two	1.74 (0.08)	2.18 (0.09)	2.67 (0.10)	3.05 (0.11)	2.87 (0.11)	2.05 (0.09)
Three	2.54 (0.10)	3.05 (0.10)	3.60 (0.12)	3.87 (0.13)	3.96 (0.13)	2.67 (0.11)
Four	3.03 (0.12)	3.61 (0.12)	4.35 (0.14)	5.01 (0.15)	4.86 (0.15)	3.31 (0.13)
Five Plus	3.72 (0.11)	4.13 (0.12)	5.11 (0.13)	5.83 (0.15)	5.81 (0.16)	4.35 (0.13)
Age of Family Head						
25-34	0.78 (0.08)	0.59 (0.09)	0.33 (0.10)	0.06* (0.11)	-0.86 (0.11)	0.60 (0.09)
35-44	1.20 (0.09)	0.90 (0.09)	0.69 (0.10)	0.89 (0.12)	0.21* (0.11)	0.19 (0.09)
45-54	1.24 (0.08)	1.10 (0.09)	0.89 (0.10)	1.06 (0.11)	0.42 (0.11)	0.29 (0.08)
55-64	1.67 (0.09)	1.77 (0.09)	1.50 (0.10)	1.70 (0.11)	1.03 (0.10)	0.69 (0.09)
65-74	1.77 (0.09)	2.09 (0.10)	2.00 (0.11)	2.43 (0.12)	1.86 (0.11)	1.19 (0.09)
75 +	1.23 (0.10)	1.25 (0.10)	0.94 (0.11)	1.73 (0.11)	1.16 (0.11)	1.06 (0.09)
R ²	0.14	0.15	0.17	0.17	0.17	0.15

^aNote: Children coefficients not in first differences.

* Not significant at the 5% level.

TABLE A.10
 PREDICTION EQUATIONS, QUANTITY OF REGIONAL
 EXAMINATIONS FOR 1968

	A	B	\hat{Y}	F	R^2	Se
Intercept	1.37 (5.53)	0.42 (5.62)	3.88	31.59	0.88	0.24
Spouse Absent						
Single Male	-1.42 (-25.31)	-0.22 (-12.79)	-2.71	163.48	0.98	0.05
Single Female	-1.59 (-14.66)	-0.05* (-1.56)	-1.89	2.45	0.27	0.10
Children Present ^a						
One	0.50 (2.78)	0.28 (5.12)	2.18	26.24	0.86	0.17
Two	1.56 (6.29)	0.31 (4.18)	3.44	17.43	0.80	0.24
Three	2.31 (12.23)	0.37 (6.44)	4.50	41.45	0.91	0.18
Four	2.65 (8.48)	0.51 (5.36)	5.69	28.78	0.87	0.30
Five Plus	3.16 (10.16)	0.59 (6.28)	6.68	39.45	0.91	0.30
Age of Family Head						
25-34	1.32 (4.95)	-0.38 (-4.73)	-0.96	22.33	0.84	0.26
35-44	1.38 (6.07)	-0.20 (-2.91)	0.18	8.49	0.65	0.22
45-54	1.45 (6.88)	-0.17 (-2.65)	0.44	7.02	0.60	0.20
55-64	1.94 (7.66)	-0.14* (-1.77)	1.13	3.13	0.35	0.24
65-74	1.87 (6.40)	0.05* (0.59)	2.19	0.35	0.10 ⁺	0.28
75 +	1.16 (3.37)	0.03* (0.33)	1.36	0.11	0.03 ⁺	0.33

⁺Unadjusted R^2 .

* Not statistically significant at the 10% level.

^aThese coefficients are not presented in first differences.

TABLE A.11
REGRESSION COEFFICIENTS AND STANDARD ERRORS, QUANTITY OF
HOME AND EMERGENCY VISITS AND FAMILY DUMMY VARIABLES,
BY YEAR

	1963	1964	1965	1966	1967	1968
Intercept	0.25	0.29	0.38	0.37	0.45	0.42
Spouse Absent						
Single Male	-0.22 (0.03)	-0.22 (0.03)	-0.27 (0.03)	-0.29 (0.03)	-0.24 (0.04)	-0.20 (0.03)
Single Female	-0.20 (0.03)	-0.21 (0.03)	-0.21 (0.03)	-0.17 (0.04)	-0.13 (0.04)	-0.08 (0.03)
Children Present ^a						
One	0.23 (0.03)	0.33 (0.04)	0.41 (0.04)	0.42 (0.04)	0.43 (0.05)	0.36 (0.04)
Two	0.50 (0.03)	0.55 (0.04)	0.65 (0.04)	0.69 (0.04)	0.69 (0.05)	0.61 (0.05)
Three	0.75 (0.04)	0.82 (0.05)	0.80 (0.05)	0.97 (0.05)	0.95 (0.06)	0.79 (0.05)
Four	0.91 (0.04)	0.97 (0.05)	1.10 (0.05)	1.30 (0.06)	1.08 (0.07)	0.91 (0.06)
Five Plus	1.12 (0.04)	1.29 (0.05)	1.41 (0.05)	1.55 (0.06)	1.54 (0.07)	1.21 (0.06)
Age of Family Head						
25-34	0.25 (0.03)	0.18 (0.04)	0.21 (0.04)	0.13 (0.04)	-0.04* (0.05)	-0.03* (0.04)
35-44	0.12 (0.03)	0.08 (0.04)	0.02* (0.04)	0.10 (0.05)	-0.02* (0.05)	-0.04* (0.04)
45-54	0.01* (0.03)	-0.08 (0.04)	-0.14 (0.04)	-0.09 (0.04)	-0.15 (0.05)	-0.15 (0.04)
55-64	0.10 (0.03)	0.05* (0.04)	0.00* (0.00)	0.07* (0.04)	0.04* (0.04)	0.00* (0.00)
65-74	0.26 (0.04)	0.35 (0.04)	0.30 (0.04)	0.42 (0.05)	0.35 (0.05)	0.27 (0.04)
75 +	0.56 (0.04)	0.71 (0.04)	0.68 (0.04)	1.16 (0.05)	1.34 (0.05)	1.24 (0.04)
R ²	0.05	0.04	0.05	0.06	0.05	0.04

^aNote: Children coefficients not in first differences.

* Not significant at the 5% level.

TABLE A.12
 PREDICTION EQUATIONS, QUANTITY OF HOME AND EMERGENCY
 VISITS FOR 1968

	A	B	\hat{Y}	F	R ²	Se
Intercept	0.20 (7.85)	0.05 (6.13)	0.49	37.57	0.90	0.02
Spouse Absent						
Single Male	-0.22 (-6.87)	-0.01* (-1.17)	-0.28	1.36	0.08	0.03
Single Female	-0.24 (-10.22)	0.02 (2.56)	-0.13	6.57	0.58	0.02
Children Present ^a						
One	0.22 (5.22)	0.05 (3.91)	0.51	15.29	0.78	0.04
Two	0.46 (14.16)	0.05 (5.31)	0.77	28.17	0.87	0.03
Three	0.69 (13.46)	0.05 (3.54)	1.02	12.55	0.74	0.05
Four	0.87 (6.81)	0.07* (1.74)	1.27	3.02	0.34	0.12
Five Plus	1.05 (17.30)	0.11 (6.00)	1.71	36.01	0.90	0.06
Age of Family Head						
25-34	0.34 (5.22)	-0.06 (-3.26)	-0.04	10.60	0.71	0.06
35-44	0.14 (2.76)	-0.03* (-1.72)	-0.02	2.96	0.33	0.05
45-54	0.01 (0.20)	-0.03 (-2.48)	-0.19	6.15	0.56	0.04
55-64	0.08 (2.02)	-0.01* (-0.82)	0.02	0.67	0.18 ⁺	0.04
65-74	0.26 (4.74)	0.03* (1.51)	0.41	2.27	0.24	0.05
75 +	0.29 (1.99)	0.20 (4.62)	1.49	21.34	0.84	0.14

⁺Unadjusted R².

* Not statistically significant at the 10% level.

^aThese coefficients are not presented in first differences.

TABLE A.13

REGRESSION COEFFICIENTS AND STANDARD ERRORS, QUANTITY OF
HOSPITAL VISITS AND FAMILY DUMMY VARIABLES,
BY YEAR

	1963	1964	1965	1966	1967	1968
Intercept	0.43	0.57	0.74	0.51	0.89	0.71
Spouse Absent						
Single Male	0.44 (0.14)	0.31* (0.16)	0.00* (0.00)	0.31 (0.19)	0.10* (0.20)	-0.05* (0.18)
Single Female	-0.58 (0.14)	-0.74 (0.16)	-0.74 (0.16)	-0.48 (0.19)	-0.79 (0.20)	-0.32* (0.19)
Children Present ^a						
One	0.98 (0.16)	1.38 (0.19)	1.26 (0.20)	1.53 (0.23)	1.27 (0.24)	1.32 (0.23)
Two	0.96 (0.18)	1.12 (0.21)	1.27 (0.22)	1.21 (0.24)	1.14 (0.26)	1.46 (0.25)
Three	1.55 (0.21)	1.92 (0.24)	2.00 (0.25)	1.90 (0.27)	1.96 (0.30)	1.58 (0.29)
Four	2.52 (0.24)	2.55 (0.28)	2.22 (0.30)	2.47 (0.32)	2.75 (0.37)	2.44 (0.35)
Five Plus	4.24 (0.24)	4.34 (0.28)	4.35 (0.29)	4.05 (0.32)	4.36 (0.37)	3.94 (0.36)
Age of Family Head						
25-34	0.24* (0.18)	0.16* (0.20)	0.31* (0.22)	0.13* (0.21)	-0.18* (0.25)	-0.11* (0.24)
35-44	0.13* (0.18)	-0.05* (0.21)	-0.11* (0.23)	0.00* (0.00)	-0.12* (0.27)	-0.11* (0.26)
45-54	0.47 (0.18)	0.38* (0.20)	0.21* (0.22)	0.30* (0.21)	0.27* (0.25)	0.25* (0.24)
55-64	1.79 (0.18)	1.57 (0.20)	1.86 (0.22)	1.65 (0.22)	1.56 (0.25)	1.58 (0.24)
65-74	2.76 (0.20)	3.70 (0.22)	3.70 (0.24)	4.40 (0.24)	3.92 (0.27)	4.38 (0.26)
75 +	4.43 (0.20)	5.24 (0.22)	5.76 (0.24)	8.52 (0.24)	8.14 (0.26)	8.49 (0.25)
R ²	0.02	0.03	0.03	0.04	0.03	0.04

^aNote: Children coefficients not in first differences.

* Not significant at the 5% level.

TABLE A.14
 PREDICTION EQUATIONS, QUANTITY OF HOSPITAL VISITS
 FOR 1968

	A	B	\hat{Y}	F	R ²	Se
Intercept	0.37 (2.42)	0.09* (1.87)	0.89	3.48	0.38	0.15
Spouse Absent						
Single Male	0.44 (2.54)	-0.07* (-1.31)	0.03	1.72	0.15	0.16
Single Female	-0.62 (-3.98)	-0.02* (-0.34)	-0.71	0.12	0.04 ⁺	0.15
Children Present ^a						
One	1.07 (5.31)	0.07* (1.21)	1.50	1.46	0.10	0.19
Two	1.01 (8.96)	0.05* (1.33)	1.28	1.77	0.16	0.11
Three	1.63 (10.40)	0.08* (1.70)	2.11	2.88	0.32	0.15
Four	2.39 (10.93)	0.04* (0.58)	2.62	0.33	0.10 ⁺	0.21
Five Plus	4.28 (27.03)	-0.01* (-0.10)	4.25	0.01	0.003 ⁺	0.15
Age of Family Head						
25-34	0.39 (2.53)	-0.09* (-1.86)	-0.13	3.45	0.38	0.15
35-44	0.11 (1.19)	-0.05* (-1.69)	-0.17	2.87	0.32	0.08
45-54	0.47 (5.80)	-0.05* (-1.97)	0.18	3.87	0.42	0.08
55-64	1.80 (12.42)	-0.04* (-0.87)	1.57	0.76	0.20 ⁺	0.14
65-74	2.79 (6.45)	0.30* (2.32)	4.60	5.37	0.52	0.41
75 +	3.21 (4.05)	1.07 (4.49)	9.63	20.12	0.83	0.75

⁺Unadjusted R².

* Not statistically significant at the 10% level.

^aThese coefficients are not presented in first differences.

TABLE A.15
REGRESSION COEFFICIENTS AND STANDARD ERRORS, QUANTITY OF
LABORATORY SERVICES AND FAMILY DUMMY VARIABLES,
BY YEAR

	1963	1964	1965	1966	1967	1968
Intercept	0.71	1.13	1.50	1.45	2.36	2.78
Spouse Absent						
Single Male	-0.70 (0.04)	-1.08 (0.05)	-1.35 (0.06)	-1.40 (0.06)	-1.85 (0.07)	-2.23 (0.07)
Single Female	-0.58 (0.04)	-0.88 (0.05)	-0.94 (0.06)	-0.80 (0.06)	-1.12 (0.07)	-1.27 (0.07)
Children Present ^a						
One	0.35 (0.05)	0.50 (0.06)	0.72 (0.07)	0.71 (0.07)	0.74 (0.09)	0.53 (0.09)
Two	0.68 (0.05)	0.91 (0.07)	1.13 (0.08)	1.30 (0.08)	1.37 (0.09)	1.26 (0.10)
Three	0.78 (0.06)	1.11 (0.08)	1.35 (0.09)	1.61 (0.09)	1.73 (0.11)	1.52 (0.11)
Four	0.87 (0.07)	1.27 (0.09)	1.49 (0.10)	1.67 (0.11)	1.87 (0.13)	1.65 (0.13)
Five Plus	0.97 (0.68)	1.27 (0.09)	1.55 (0.10)	1.74 (0.11)	1.99 (0.13)	1.91 (0.14)
Age of Family Head						
25-34	0.29 (0.05)	0.32 (0.06)	0.24 (0.08)	0.24 (0.08)	-0.38 (0.09)	-0.36 (0.09)
35-44	0.60 (0.05)	0.66 (0.07)	0.62 (0.08)	0.74 (0.08)	0.47 (0.10)	0.42 (0.10)
45-54	0.56 (0.05)	0.76 (0.07)	0.78 (0.08)	0.89 (0.08)	0.57 (0.09)	0.48 (0.09)
55-64	0.81 (0.05)	0.98 (0.07)	0.85 (0.08)	1.04 (0.08)	0.72 (0.09)	0.51 (0.09)
65-74	0.70 (0.06)	1.06 (0.07)	1.16 (0.08)	1.52 (0.08)	1.26 (0.10)	1.04 (0.10)
75 +	0.56 (0.06)	0.73 (0.07)	0.61 (0.08)	1.07 (0.08)	0.76 (0.09)	0.76 (0.10)
R ²	0.05	0.06	0.07	0.08	0.08	0.08

^aNote: Children coefficients not in first differences.

* Not significant at the 5% level.

TABLE A.16
 PREDICTION EQUATIONS, QUANTITY OF LABORATORY SERVICES
 FOR 1968

	A	B	\hat{Y}	F	R ²	Se
Intercept	0.34 (1.39)	0.36 (4.84)	2.52	23.38	0.85	0.24
Spouse Absent						
Single Male	-0.49 (-4.38)	-0.26 (-7.77)	-2.06	60.43	0.94	0.11
Single Female	-0.56 (-3.92)	-0.10* (-2.31)	-1.16	5.33	0.52	0.14
Children Present ^a						
One	0.31 (3.54)	0.10 (3.79)	0.90	14.34	0.77	0.08
Two	0.55 (8.78)	0.18 (9.42)	1.61	88.75	0.96	0.06
Three	0.60 (8.73)	0.24 (11.66)	2.04	135.85	0.97	0.06
Four	0.71 (8.81)	0.24 (9.82)	2.15	96.44	0.96	0.08
Five Plus	0.75 (19.84)	0.25 (21.99)	2.26	483.76	0.99	0.03
Age of Family Head						
25-34	0.57 (2.48)	-0.14* (-2.05)	-0.28	4.21	0.45	0.22
35-44	0.67 (5.88)	-0.02* (-0.52)	0.56	0.27	0.08 ⁺	0.11
45-54	0.67 (3.90)	0.02* (0.29)	0.76	0.08	0.03 ⁺	0.16
55-64	0.92 (5.91)	-0.01* (-0.26)	0.84	0.07	0.02 ⁺	0.15
65-74	0.67 (3.32)	0.16 (2.61)	1.61	6.84	0.59	0.19
75 +	0.52 (2.69)	0.07* (1.26)	0.97	1.58	0.13	0.19

⁺Unadjusted R².

*Not statistically significant at the 10% level.

^aThese coefficients are not presented in first differences.

TABLE A.17
REGRESSION COEFFICIENTS AND STANDARD ERRORS, QUANTITY OF
MAJOR SURGERY AND FAMILY DUMMY VARIABLES,
BY YEAR

	1963	1964	1965	1966	1967	1968
Intercept	0.17	0.21	0.24	0.26	0.36	0.39
Spouse Absent						
Single Male	-0.16 (0.01)	-0.19 (0.01)	-0.22 (0.02)	-0.26 (0.02)	-0.30 (0.02)	-0.32 (0.02)
Single Female	-0.22 (0.10)	-0.25 (0.01)	-0.26 (0.02)	-0.26 (0.02)	-0.30 (0.02)	-0.32 (0.02)
Children Present ^a						
One	0.06 (0.02)	0.06 (0.02)	0.10 (0.02)	0.09 (0.02)	0.08 (0.02)	0.05 (0.02)
Two	0.06 (0.02)	0.10 (0.02)	0.15 (0.02)	0.15 (0.02)	0.11 (0.02)	0.11 (0.03)
Three	0.13 (0.02)	0.15 (0.02)	0.21 (0.02)	0.24 (0.03)	0.27 (0.03)	0.21 (0.03)
Four	0.18 (0.02)	0.24 (0.02)	0.22 (0.03)	0.25 (0.03)	0.37 (0.04)	0.19 (0.04)
Five Plus	0.29 (0.02)	0.32 (0.02)	0.38 (0.03)	0.39 (0.03)	0.41 (0.04)	0.37 (0.04)
Age of Family Head						
25-34	0.07 (0.02)	0.05 (0.02)	0.05 (0.02)	0.01 (0.02)	-0.07 (0.02)	-0.05 (0.02)
35-44	0.17 (0.02)	0.15 (0.02)	0.18 (0.02)	0.17 (0.02)	0.14 (0.03)	0.15 (0.03)
45-54	0.22 (0.02)	0.22 (0.02)	0.30 (0.02)	0.28 (0.02)	0.28 (0.02)	0.29 (0.02)
55-64	0.32 (0.02)	0.33 (0.02)	0.40 (0.02)	0.44 (0.02)	0.42 (0.02)	0.41 (0.02)
65-74	0.34 (0.02)	0.42 (0.02)	0.53 (0.02)	0.59 (0.02)	0.56 (0.03)	0.57 (0.03)
75 +	0.24 (0.02)	0.30 (0.02)	0.34 (0.02)	0.44 (0.02)	0.45 (0.02)	0.49 (0.03)
R ²	0.04	0.04	0.05	0.05	0.05	0.05

^aNote: Children coefficients not in first differences.

TABLE A.18

PREDICTION EQUATIONS, QUANTITY OF MAJOR SURGERY
FOR 1968

	A	B	\hat{Y}	F	R ²	Se
Intercept	0.12 (4.65)	0.04 (5.57)	0.38	30.99	0.88	0.02
Spouse Absent						
Single Male	-0.12 (-23.88)	-0.04 (-22.91)	-0.33	525.13	0.99	0.11
Single Female	-0.21 (-17.31)	-0.02 (-4.71)	-0.31	22.33	0.84	0.02
Children Present ^a						
One	0.06 (3.35)	0.01* (1.36)	0.10	1.86	0.18	0.02
Two	0.07 (1.93)	0.02* (1.39)	0.16	1.95	0.19	0.03
Three	0.09 (8.35)	0.04 (11.51)	0.31	132.49	0.97	0.01
Four	0.14 (3.13)	0.04 (3.00)	0.37	9.00	0.67	0.04
Five Plus	0.27 (16.91)	0.03 (6.56)	0.45	43.04	0.91	0.02
Age of Family Head						
25-34	0.12 (4.12)	-0.03 (-3.70)	-0.07	13.71	0.76	0.03
35-44	0.17 (9.47)	-0.004* (-0.72)	0.15	0.52	0.15 ⁺	0.02
45-54	0.21 (7.00)	0.02* (2.03)	0.31	4.12	0.44	0.03
55-64	0.29 (10.49)	0.03 (3.73)	0.48	13.93	0.76	0.03
65-74	0.31 (6.17)	0.06 (4.09)	0.67	16.74	0.80	0.05
75 +	0.19 (8.33)	0.06 (8.32)	0.52	69.19	0.94	0.02

⁺Unadjusted R².

*Not statistically significant at the 10% level.

^aThese coefficients are not presented in first differences.

TABLE A.19
REGRESSION COEFFICIENTS AND STANDARD ERRORS, QUANTITY OF
MINOR SURGERY AND FAMILY DUMMY VARIABLES,
BY YEAR

	1963	1964	1965	1966	1967	1968
Intercept	0.11	0.13	0.16	0.15	0.18	0.18
Spouse Absent						
Single Male	-0.06 (0.01)	-0.07 (0.01)	-0.07 (0.01)	-0.08 (0.01)	-0.07 (0.01)	-0.07 (0.01)
Single Female	-0.08 (0.01)	-0.08 (0.01)	-0.08 (0.01)	-0.08 (0.01)	-0.08 (0.01)	-0.08 (0.01)
Children Present ^a						
One	0.04 (0.01)	0.05 (0.01)	0.10 (0.01)	0.07 (0.01)	0.11 (0.01)	0.09 (0.01)
Two	0.10 (0.01)	0.13 (0.01)	0.17 (0.01)	0.16 (0.01)	0.22 (0.01)	0.18 (0.01)
Three	0.17 (0.01)	0.19 (0.01)	0.24 (0.01)	0.23 (0.01)	0.31 (0.01)	0.25 (0.01)
Four	0.25 (0.01)	0.28 (0.01)	0.32 (0.01)	0.31 (0.01)	0.36 (0.02)	0.33 (0.02)
Five Plus	0.32 (0.01)	0.38 (0.01)	0.44 (0.01)	0.45 (0.01)	0.48 (0.02)	0.44 (0.02)
Age of Family Head						
25-34	0.02 (0.01)	-0.001 (0.01)	-0.02 (0.01)	-0.04 (0.01)	-0.07 (0.01)	-0.06 (0.01)
35-44	0.02 (0.01)	0.01 (0.01)	-0.02 (0.01)	0.01 (0.01)	-0.02 (0.01)	-0.03 (0.01)
45-54	0.01 (0.01)	-0.004 (0.01)	-0.03 (0.01)	-0.002 (0.01)	-0.03 (0.01)	-0.02 (0.01)
55-64	0.01 (0.01)	0.00 (0.00)	-0.03 (0.01)	0.00 (0.00)	-0.03 (0.01)	-0.04 (0.01)
65-74	0.00 (0.01)	-0.02 (0.01)	-0.04 (0.01)	-0.01 (0.01)	-0.04 (0.01)	-0.06 (0.01)
75 +	-0.01 (0.01)	-0.02 (0.01)	-0.04 (0.01)	-0.03 (0.01)	-0.05 (0.01)	-0.05 (0.01)
R ²	0.06	0.07	0.07	0.07	0.07	0.06

^aNote: Children coefficients not in first differences.

TABLE A.20
 PREDICTION EQUATIONS, QUANTITY OF MINOR SURGERY
 FOR 1968

	A	B	\hat{Y}	F	R ²	Se
Intercept	+0.10 (8.53)	0.02 (4.62)	0.19	21.33	0.84	0.01
Spouse Absent						
Single Male	-0.06 (-9.60)	-0.003* (-1.57)	-0.08	2.45	0.27	0.01
Single Female	-0.08	0.00	-0.08			
Children Present ^a						
One	0.03 (1.26)	0.02 (2.57)	0.12	6.62	0.58	0.02
Two	0.07 (4.30)	0.03 (5.13)	0.24	26.35	0.86	0.02
Three	0.13 (5.74)	0.03 (4.62)	0.32	21.33	0.84	0.02
Four	0.23 (14.61)	0.03 (5.29)	0.38	27.99	0.87	0.02
Five Plus	0.30 (14.72)	0.04 (6.41)	0.53	41.11	0.91	0.02
Age of Family Head						
25-34	0.04 (11.49)	-0.02 (-19.05)	-0.09	363.01	0.99	0.00
35-44	0.02 (1.44)	-0.01* (-1.59)	-0.02	2.53	0.28	0.02
45-54	0.01 (0.84)	-0.01* (-1.59)	-0.03	2.53	0.28	0.02
55-64	0.01 (0.84)	-0.01* (-1.59)	-0.03	2.53	0.28	0.02
65-74	-0.00 (-0.06)	-0.01* (-1.36)	-0.04	1.86	0.18	0.02
75 +	-0.003 (-0.36)	-0.01 (-3.58)	-0.06	12.79	0.75	0.01

*Not statistically significant at the 10% level.

^aThese coefficients are not presented in first differences.

APPENDIX B

THE INCOME SEARCH PROCEDURE

THE INCOME SEARCH PROCEDURE

The three sources of data used in this study are the Master Registration File of the Saskatchewan Hospital Services Plan, the Patient History File of the Medical Care Insurance Commission, and the Income Tax File of the Saskatchewan Treasury Department. The content and format of the records in these files are illustrated in Figure B.1, B.2, and B.3 respectively. The Master Registration File provided the population list from which a random sample of families was drawn. Data on medical care expenditures were then collected from the Patient History File. Since these two files contain a common identification scheme, no problems were encountered in drawing the medical care data for the sample. The medical care histories could be selected straightforwardly on the basis of the registration-beneficiary number.

The selection of the income data for individuals in the sample was more difficult. Since records in the Income Tax File are not identified by the registration-beneficiary number, some means of linking the data sources had to be devised. Linkage, of course, had to be based upon name, age, and address information common to the two files.

A number of difficulties were encountered in undertaking such a linkage. Not only are the formats of the two files different, but also keypunching conventions are neither common nor consistent. In

REG. NUMBER
BEN. NUMBER
RECORD TYPE P
SEX
BIRTH DATE
MARRIAGE STATUS
BEN. ACTIVITY
BEN. EXCEPTION
NAME
OTHER NUMBER
NEW/OLD INDIC
SURNAME INITIAL
EFFECTIVE DATE
FILLER
NUMBER OF COVERAGE ENTRIES
COVERAGE TYPE & SOURCE
FILLER
BEGIN DATE
END DATE
COVERAGE TYPE & SOURCE

BENEFICIARY RECORD

REG. NUMBER
FILLER
RECORD TYPE P
MUN. PL RESIDENCE CODE
SWIFT CURRENT INDIC.
MAILING NAME
ADDRESS LINES
RECEIPT FLAG
FILLER
VETERAN REGION
FILLER (SUP)
NUMBER OF TRAILERS

FAMILY RECORD

FIGURE B.1. TAPE LAYOUT FOR MASTER REGISTRATION FILE

REG. NUMBER	
BEN. NUMBER	
ASSESS. STATE	
SEX	
≠ BIRTH	
< DATE	
STATUS FLAG	
RUN CODE	
CLINIC No.	
DOCTOR No.	
CLAIM No.	
REFERRING DOCTOR No.	
DIAGNOSIS	
DCB	
ADJUS CODE	
MODE PAYMENT	
SPECIALTY	
FAILURE RULE	
REJECT ANALYSIS	
FILLER	
No. SERVICE LINES	
FIRST DATE SERVICE	
LAST DATE SERVICE	
No. SERVICES	
F. S. C. SUBMITTED	
FEE SUBMITTED	
F. S. C. APPROVED	
FEE APPROVED	
-	
ASSESS GROUPS	
ASSESS CODE	
EXP CODE	
FILLER	

FIGURE B.2. TAPE LAYOUT FOR PATIENT HISTORY FILE

addition, the structure and organization of the tax files imposes further difficulties. Finally, the sources from which data are collected for the two files differ causing variations in the quality of the data.

A computer program was prepared to search the Tax File for income information for the individuals in the sample. The criteria upon which the search was based were name, age, and address. Since it was desirable to know how many of these characteristics matched for each income record selected, a "credibility index" was assigned to the selected record. The system of credibility index assignment and the sequence of the search conditions are illustrated in Figure B.4. The highest level of credibility, 99, indicates that all of the name, age, and address characteristics matched. The reliability of the search program as indicated by these indices will be examined later. It should be noted that the running of the search program was conducted under the supervision of the Saskatchewan Government Computer Centre. The author did not have access to the Tax Files for reasons of confidentiality. The income information yielded by the search contained no name-address identifying information.

The search program is comprised of three major sub-routines; the name sub-routine, the age sub-routine, and the address sub-routine. Each of these routines are discussed generally below to illustrate the kinds of problems that were encountered in the search.

An overall constraint imposed on processing was that the Income Tax Files were sorted only by the first five characters of the surname. As a consequence either rewinding of tapes was required or batch processing. Batch processing means dealing with groups of

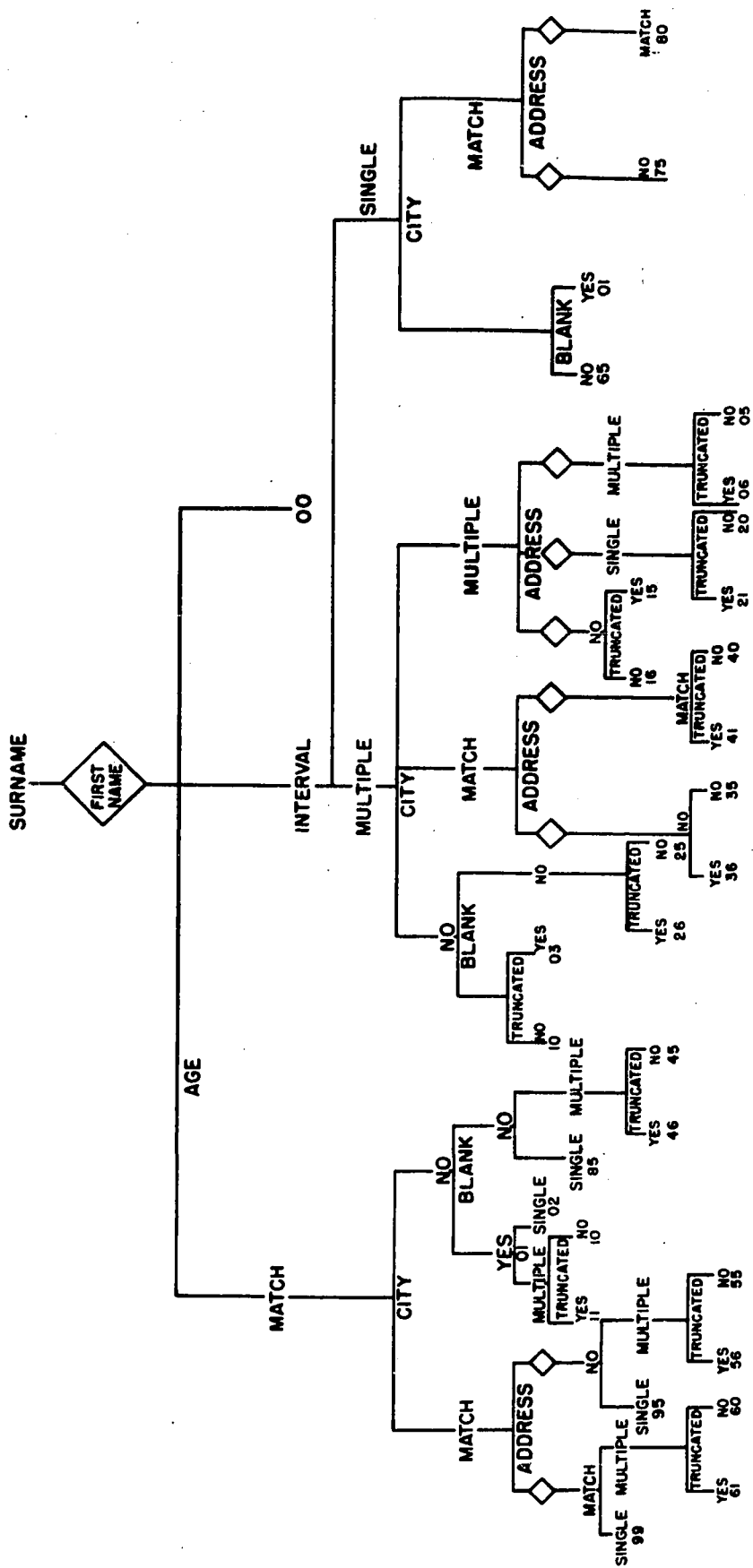


FIGURE B.4. SCHEMA OF SEARCH ROUTINE AND CREDIBILITY INDEX ASSIGNMENT

equivalent first-five-character surnames. Since it is more efficient than rewinding tapes, batch processing was employed. In addition, since the sample batches were smaller than the population batches, the direction of the search was reversed. That is, the Tax File was read and the sample was searched for a corresponding record.

The task of the name sub-routine was to match the surnames and first names. Considering surnames, the major difficulty was differences in format of the two records. The Master Registration record provides a single field which contains both the surname and the first name. The latter is separated from the former by a blank. Blanks which might ordinarily appear in a surname are replaced by a hyphen. The first task, therefore, is to locate the surname in the field and to delete imbedded hyphens if necessary. The second problem arises from a difference in the length of the surname field in the two records. The tax record allows a separate ten character field for surnames, while the Master Registration record allows up to nineteen characters. As a consequence, it is possible to get more than one tax record matching a given Master Registration record merely because the discriminating characters in the surname occur beyond the tenth character. Of course, it is possible for this to occur also because of common surnames such as "Smith" or "Jones". As a result the possibility of "multiple matches" was allowed for as indicated in Figure B.4. A "multiple match" is defined as two or more tax records associated with a given Master Registration record.

The next problem in matching names occurs when considering first names. The problems arise owing to different sources of the data, and owing to different formats of the field. The first name of the Master

Registration record is provided by the individual when he registers, usually in person, at one of the field offices in the province (usually the City Hall). First names are, therefore, usually given in full and may be contained in the record if sufficient space is left after the surname. The tax record information, on the other hand, is provided on the income tax claim that is mailed to the Department of National Revenue. Any combination of full first names or initials may be provided, subject to the limitation that they fit into the five character field allowed in the tax record. The task of the first name routine, if the first name information did not match on the first attempt, was to try various arrangements of initials and full names.¹ The only limitation imposed here was that initial reversal was not allowed due to the effect upon processing time and core requirements.

The age sub-routine dealt with the age information in the two records. Age information in the Master Registration record is reasonably reliable as it is checked against information from Vital Statistics. The age information in the tax record, submitted in number form by mail, is subject to both errors in recall and errors in recording. Age errors of up to two years were allowed. Records that fell into the "age interval" category were later edited and upgraded if the age error occurred in the month field.

The most complex sub-routine was the address sub-routine. All of the types of problems encountered above occur also in the address field, in addition to the problem of no uniform keypunching conventions. The Master Registration record contains two fields for address, a first

¹In the 1967 run the first name routine was called upon about 50% of the time, even in the cases of 99 levels of credibility.

line and a second line. Ordinarily the street address occurs in the first line and the city address in the second line. However, if there is no street address, the city is moved to the first line. The tax record has separate fields for street, city, and province.

The address information for the Master Registration record is more uniform in the way that it is reported because of the method of registration as mentioned above. Tax address information, on the other hand, is simply that provided on the mailed tax form. It is keypunched as it appears on the submitted claim and, therefore, is subject to a multitude of abbreviations, spelling errors, and variations in order. The address sub-routine was written so as to accommodate a very large number of such differences.² An additional problem, however, is the currency of the two sets of information. The address information in the Master Registration record was the address as of the data of sampling, June 1969. The address in the tax file is, of course, the address at the time the income tax claim was filed in the respective years. Therefore, a deterioration in the address part of the search is expected as the search moves back in time. The deterioration would presumably be most pronounced for street address since more intra-city mobility may be expected than inter-city mobility and inter-provincial mobility.

Data on the performance of the search program may be considered in evaluating the reliability of the search procedure. Table B.1 shows the number of individuals for whom income tax records were sought. The reduction in the total number of records found in earlier years is

²The complexity of the program is indicated by the length of time required to construct and run the program. It took about five months to write and debug the program. The run time varied from four to six hours depending upon the year.

attributable in part to the deterioration in the address information.

TABLE B.1
INCOME RECORDS FOUND AND NOT FOUND, BY YEAR

	1963	1964	1965	1966	1967	1968
Found	32,009	34,850	35,278	38,882	38,027	37,119
Not found	--*	--*	--*	38,219	32,114	35,184
	*	*	*	77,101	70,141	72,303

*Information not available owing to a malfunction of a counter in the program.

The composition of groups of individuals for whom no 1967 income record was found is presented in Table B.2. Young people, wives, the aged, and welfare recipients are least likely to have taxable income. The table provides data on the number of such individuals with the exception of welfare recipients.³ From the number of individuals for whom no income record was found, the number of less likely cases may be subtracted. Married women account for 13,935, those less than 18 years of age for 9,874, and those over 67 years of age for 4,442. This leaves 10,649 individuals with no current income for 1967. Assuming that about 27 per cent of these people are on welfare, this leaves 7,774 individuals who either had no income in 1967 or the search program missed.

Table B.3 shows the distribution of the income records found by single and multiple match. As the table indicates, a large proportion of the records found were single matches. The multiple match records

³From another tabulation on the 1968 data, of the 5,432 families with no income, 1,244 were on welfare for the whole year and 215 were on welfare part of the year.

TABLE B.2

DISTRIBUTION OF INDIVIDUALS NOT FOUND IN THE 1967 TAX
FILE BY AGE, SEX, AND MARITAL STATUS

Age in 1967 in Years	<u>Single</u>		<u>Married</u>		<u>Other</u>		Total
	Male	Female	Male	Female	Male	Female	
Less than 16	2099	1984	--	5	--	--	4,088
16	859	945	--	25	--	2	1,831
17	1075	1272	1	64	--	2	2,414
18	713	919	1	112	--	2	1,747
19	500	717	36	201	--	7	1,461
20	363	594	66	253	--	13	1,289
21	247	397	83	265	3	10	1,005
22	113	167	55	242	3	12	592
23	83	98	51	249	5	16	502
24	74	69	62	259	2	11	477
25	44	58	74	291	5	20	492
26 to	854	602	2826	9529	202	840	14,853
59	33	14	87	225	7	50	416
60	25	6	94	176	7	67	375
61	20	8	65	169	10	44	316
62	18	13	72	159	16	62	340
63	12	16	76	160	14	62	340
64	20	7	80	171	12	68	358
65	29	8	71	124	18	56	306
66	<u>377</u>	<u>97</u>	<u>1404</u>	<u>1256</u>	<u>659</u>	<u>1905</u>	<u>5,698</u>
67+	7558	7991	5204	13,935	963	3249	38,900*
Total							

*This total does not correspond to that in Table B.1 because the Table is based upon output that contain overlap due to restarts during the run. Table B.1 is based upon later totals after the output was cleaned up.

were condensed by averaging the incomes if the size of the multiple was no greater than six and if the range in income was no greater than \$6,000. Table B.4 shows the number of averaged records yielded by this procedure. In 1963, the 5,826 multiple income records were averaged to yield income observation for 1,895 individuals in the sample.

TABLE B.3
NUMBER OF SINGLE AND MULTIPLE MATCH INCOME
RECORDS, BY YEAR

	1963	1964	1965	1966	1967	1968
Singles	26,183	28,525	29,429	32,898	32,738	32,427
Multiples	<u>5,826</u>	<u>6,325</u>	<u>5,849</u>	<u>5,984</u>	<u>5,289</u>	<u>5,203</u>
Total	32,009	34,850	35,278	38,882	38,027	37,630

TABLE B.4
RESULTS OF AVERAGING MULTIPLE INCOME
RECORDS, BY YEAR

	1963	1964	1965	1966	1967	1968
Multiples	5,826	6,325	5,849	5,984	5,289	5,203
Averaged Records	1,895	2,028	1,801	1,844	1,463	1,442

Table B.5 shows the type and number of income observations obtained and the number of families in the sample by year. While no doubt some of the sample families have more than one income receiver, the data in the table suggests that income information was obtained for a large proportion of the families in the sample.

TABLE B.5

NUMBER OF FAMILIES IN THE SAMPLE AND NUMBER OF
INDIVIDUALS' INCOME RECORDS, BY YEAR

	1963	1964	1965	1966	1967	1968
Singles	26,183	28,525	29,429	32,898	32,738	32,439
Averaged Records	1,895	2,028	1,801	1,844	1,463	1,442
Total Income Observations	28,078	30,553	31,230	34,742	34,201	33,881
Number of Families in Sample	38,973	40,391	38,057	37,854	38,138	38,348

Finally, the distributions of records found by the level of their credibility index are presented in Table B.6. It may be noted that a large proportion of the records have a credibility index of 65 or better. This, of course, merely restates the fact noted above, that a large proportion of the matches were single matches.

In summary, the above data and the comparison of population and sample income distributions presented in Chapter Three suggest that the income search program performed well.

TABLE B.6

DISTRIBUTION OF CREDIBILITY INDEX, BY YEAR

CR.	1963	1964	1965	1966	1967	1968
1	33	53	65	75	51	38
2	18	40	104	209	383	446
3	2	8	--	6	6	4
5	4	2	4	16	11	10
6	0	0	0	4	2	2
10	49	116	148	203	195	166
15	301	343	275	287	350	256
16	2	2	--	5	3	2
20	30	35	39	40	40	49
25	4,371	4,596	4,258	3,948	3,497	3,277
26	50	54	45	46	51	49
35	419	424	386	409	386	348
36	5	7	6	9	10	11
40	134	135	148	185	199	196
41	3	4	5	7	5	6
45	999	1,140	1,053	1,212	1,115	860
46	6	12	8	18	10	12
55	36	42	46	111	39	34
56	0	0	0	6	2	--
60	6	10	12	12)	8	8
61	0	0	0	2	--	--
65	2,732	2,836	2,377	2,183	1,778	1,736
75	690	707	643	683	648	646
80	755	803	888	1,016	1,075	1,155
85	5,566	5,876	5,567	5,499	4,285	3,608
95	7,147	8,054	8,284	9,220	9,054	8,350
99	<u>8,651</u>	<u>9,557</u>	<u>10,917</u>	<u>13,363</u>	<u>14,824</u>	<u>15,850</u>
Total	32,009	34,850	35,278	38,882	38,027	37,119

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